ANNUAL REPORT 1971

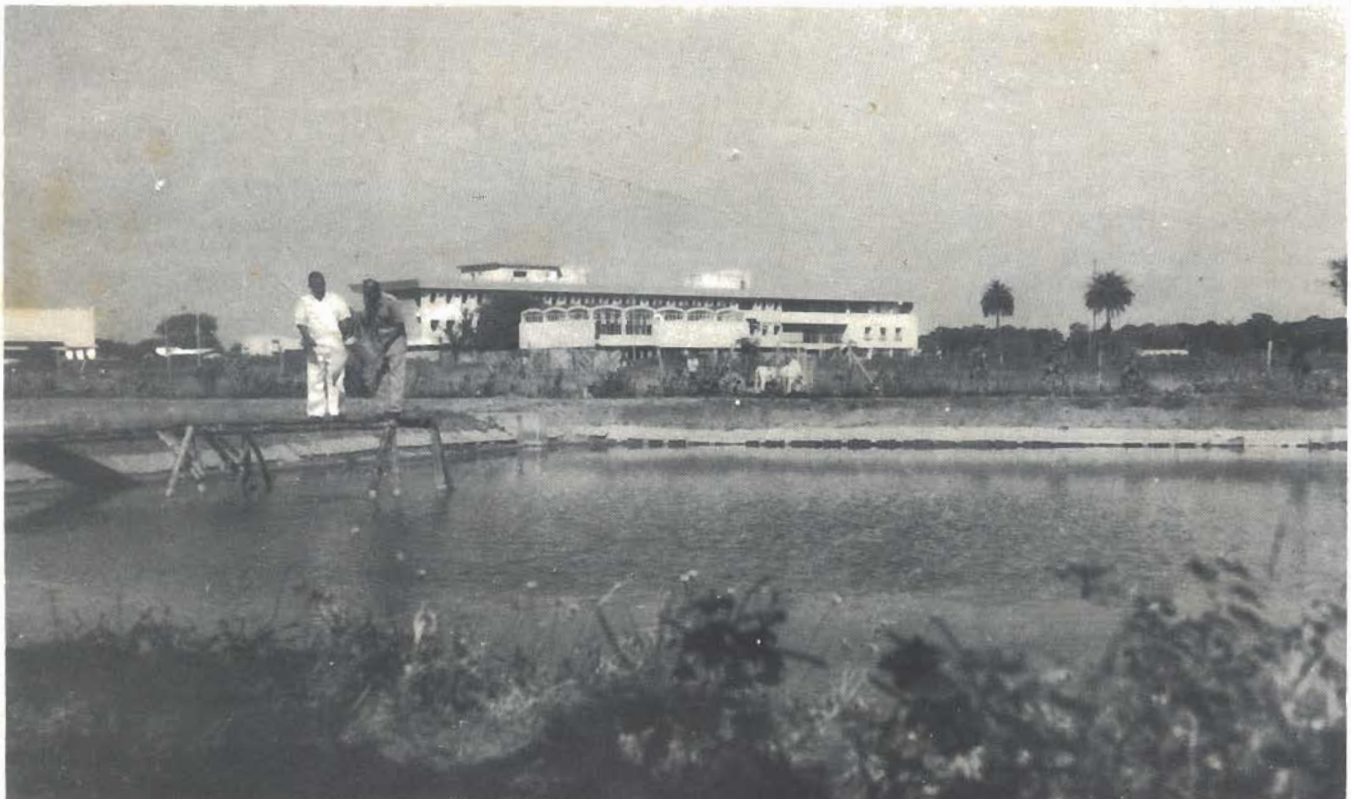
Technicians measure air pollution

CENTRAL PUBLIC HEALTH ENGINEERING RESEARCH INSTITUTE

NAGPUR 10.

INDIA

A view of the oxidation ponds at the
Institute's campus



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CPHERI

ANNUAL REPORT
1971

CENTRAL PUBLIC HEALTH ENGINEERING RESEARCH INSTITUTE
NEHRU MARG : NAGPUR-10 (INDIA)

CONTENTS

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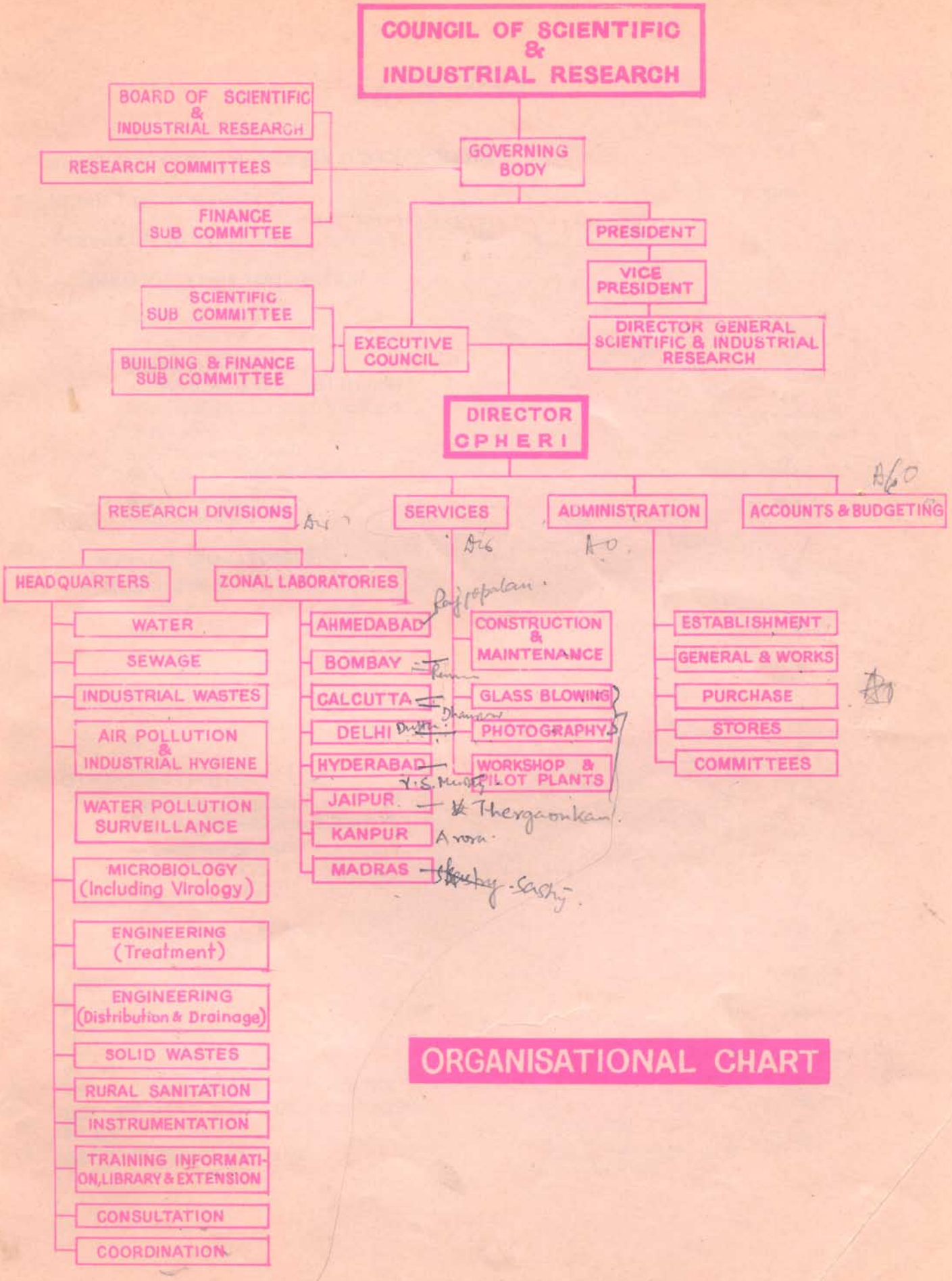


ORGANISATIONAL CHART

REPORT OF THE DIRECTOR

REPORT OF THE DIRECTOR

I deem it a great pleasure to present the Annual Report of the Institute for the Calendar year - 1971.

I would like to take this opportunity to refer here briefly the highlights of the Institute's work during the year.

R & D Conference

During the year, the Institute organised, for the first time in the country, a Research & Development (R & D) Conference on Public Health Engineering needs in India, for 3 days from 28th to 30th January 1971. The Conference was inaugurated at the hands of Dr. Atma Ram, former Director-General, Scientific & Industrial Research. The Conference which was attended by about 140 participants comprising eminent scientists, engineers, doctors, administrators and others engaged in public health engineering work, provided an ideal opportunity to draw upon the expertise available in the country in a sizeable measure to identify with keen perceptiveness and realism the research and development needs in the field with priorities laid down for the next ten years. The recommendations made at the conference have been brought out in the form of a booklet : " Research & Development Needs in Public Health Engineering in India."

Research Projects

During the year, the Institute has worked on 165 research projects, including 41 sponsored schemes, at its headquarters at Nagpur and 8 Zonal Laboratories. Work on 48 projects was completed during the year.

To the already existing pilot plants, a new unit, Biological Disc was added, with a view to study efficiency and economics of this method in waste water treatment.

Water

The Institute's "know-how" on defloridation of water is being made available to the Government of Tanzania. The Institute has submitted a preliminary report based on 'on-site' investigations recommending installation of a defloridation plant wherein "defloron-2" developed indigenously by the Institute will be used for the purpose.

During the year, the process for preparation of membrane filters was handed over to the NRDC for commercial exploitation. This will enable adoption of MF Technique, known for quickness in bacteriological analysis of water and waste waters, in the country which was not possible hitherto since membrane filters were required to be imported.

Work on coagulant aids, filter aids and deferrisation was continued. Studies on reverse osmosis for desalination of water has been taken up.

The Institute has given advice to the Government of Maharashtra on water filtration for the Umrer Water Supply Scheme. The Department has decided to go in for slow sand filtration, on the basis of the Institute's recommendations.

The search to locate indigenous material to substitute anthracite in two-layer filtration was completed during the year. Good quality bituminous coal is found to act sufficiently well as substitute for anthracite, This will make it possible to bring two-layer filtration, known for increased output, to this country.

Sewage

Work on the low cost waste treatment methods, *viz.*, stabilisation pond, aerated lagoon and "Pasveer-Type" Oxidation Ditch was continued. It is proposed to examine the efficacy of biological discs in treatment of sewage and, with this view, a pilot unit is installed and is ready for operation.

A survey of sewage farms was completed. It has enabled collection of important data on sewage farm practices in the country and the associated health hazards.

During the year, M/s Dorr-Oliver (India) have sponsored a research/developmental project on Surface Aerators for biological waste treatment which would give optimum output with regard to oxygenation capacity per unit energy consumed and to determine the mixing characteristics of the same.

Industrial Waste Treatment

At the request of the Indian Petrochemical Complex, the Institute worked out method for treating wastes from their Aromatics Project, Baroda. Since the actual project has yet to start, the Institute worked on simulated wastes and furnished alternative flow-sheets incorporating aerobic processes along with cost estimates and land requirements.

Another interesting piece of work done during the year was recovery of yeast *Torula utilis*, rich in protein, from prehydrolysate liquor of rayon pulp wastes. Optimum conditions for the yeast growth are worked out and a patent is being sought for the process.

Water Pollution Surveillance

A new wing "Water Pollution Surveillance Division" was created during the year in order to be able to plan and undertake exploratory surveys of the chemical, biological and bacteriological characteristics of as many large rivers and other water bodies as possible. This background information on the quantity, quality and diurnal variations in the water quality will be of great importance in planning and design of water supply and treatment schemes and in judging the adequacy and suitability of waters necessary for industrial entreprises.

A model study is proposed to be started soon on Gomti River (U. P.) in collaboration with the Local Self Government Engineering Department, U. P.

Microbiology (including Virology)

Work on development of indigenous syathetic medium (ammonium sulphate broth) to substitute the imported McConkey broth in bacteriological analysis of water and waste water was successfully completed during the year.

Tests on the CPHERI developed improved techniques for concentration and quantitation of small amounts of viruses from large volumes of water and waste water show that the technique is suitable for monitoring of sewage and effluents from sewage treatment plants.

Work on use of soil cultures to knock off the toxic constituents from some of the industrial wastes such as cyanides, phenols hexavalent chromium etc. is in progress.

Air Pollution Control

National air sampling network programme was continued during the year. Few more cities are likely to be added where the programme will be carried out in collaboration with the respective Engineering Colleges.

Sponsored city air pollution surveys are in progress for the CIDCO and the Bombay Municipal Corporation.

Assistance was also rendered to Industries by way of assessing the atmospheric pollution caused due to industrial emissions and suggesting remedial measures. The nature of assistance rendered is described elsewhere in the report.

Development of equipment and standardisation of analytical techniques was continued for air monitoring work.

Solid Wastes Disposal

Nationwide collection of data about quality, quantity of refuse covering all variations of climatic conditions and dietary habits is being carried out with financial aid from the PL-480 funds. The work is just started. Similarly data on the cost of transport and disposal of refuse from cities are being collected.

Instrumentation

The division continued maintenance and repairs of sophisticated equipment received under UNDP Assistance and development of instruments for research work of the Institute. Facilities for instrumental analyses were also provided to outside organisations.

Training Facilities

The Institute offers training courses to suit the needs of the field personnel in public health engineering. Nine courses were offered during the year and these received an overwhelming response. One of these "Process Design in Waste Treatment" was organised in collaboration with the Government Polytechnic, Nagpur and another one "Corrosion Control in Water & Waste Water Engineering" in collaboration with the Corrosion Advisory Bureau of the Council of Scientific & Industrial Research, Jamshedpur. Some foreign students also took advantage of these courses.

Symposia and Seminars

At the R & D Conference on Public Health Engineering Needs in India, it was felt, amongst many other needs, that the Institute has numerous achievements to be made known to the users and for expediting this transfer of technology to the field, the Institute should organise one-day seminars at various places wherein interested agencies could be involved to participate. The Institute accordingly organised one-day seminar on "Treatment & Disposal of Dairy Wastes" on 19th April 1971 at Baroda, in collaboration with the M. S. University. This maiden attempt was a great success.

The Institute participated in the special session on various aspects of Pulp & Paper Mill Waste at the Annual Meeting of the Indian Pulp and Paper Technical Association held at New Delhi. One of the papers presented by the Institute was adjudged as the best paper and was awarded a Gold Medal.

Sponosored/Consultation Work

The Institute continued to render advice to a large number of enquiries received from government departments, public undertakings, private industries, municipalities and public health engineering departments of the States on a variety of problems dealing with water supply, sewage, industrial waste treatment and air pollution control.

Besides, the Institute supplied technical notes and answers to queries from a large number of organisations and public bodies.

U. S. Scientists Visit CPHERI

A team of Scientists from USA came to attend a joint workshop on "Water in Man's Life in India," organised by the US Academy of Sciences and Indian National Science Academy in Delhi. Prior to their participation in that workshop, 8 scientists of the U. S. team selected to visit CPHERI to acquaint themselves with the activities of this Institute.

Publications

The title of the quarterly journal "Environmental Health" has been changed to "Indian Journal of Environmental Health" from this year.

The Institute continued to bring out the "Technical Digest."

A feature article on CPHERI activities was published in the magazine "SPAN" and also a special article in "World Health" Bulletin (August-September 1971 issue).

Vigyan Pragati—a Hindi journal on Popular Science brought out by the Indian Languages Unit of C. S. I. R. highlighted some of the research activities of the Institute through its special issue on 'Health Hazards'.

W. H. O. Assistance

The Institute continued its working as a WHO Regional Reference Centre on Air Pollution and as a Collaborating Institute of the WHO International Reference Centre (IRC) on Community Water Supply and Waste Disposal.

During the year, Ir. Th. G. Martijn, Manager, WHO IRC on Community Water Supply, The Hague, paid a visit to the Institute and opined that a feature story on CPHERI as a case history of "How to Set up a Research Institution" should be published in one of the special issues of IRC Newsletter The feature article has been prepared and is expected to be published soon. CPHERI has also sent some of its products/processes to the WHO IRC on Community Water Supply at the Hague for display. The WHO continued to award fellowships to the people in the field to enable them to visit this Institute and study its activities.

The Institute remains ever grateful to the WHO for its active support in its development to present stage where its activities have won appreciation from several parts of the world.

Prof. S. J. Arceivala, Director, CPHERI resigned with effect from 31st Aug. 1971 to take up an assignment with the World Health Organisation. Dr. G. J. Mohanrao, Scientist took over the charge as Scientist-In-Charge from 1st Sept. 1971.

We record with deep regret that Shri N. V. Modak, Founder Director of the Institute and reputed public health engineer passed away on 26th Oct. 1971.

In conclusion, I must express my sincere thanks to all the staff members both at the Headquarters and Zonal Laboratories for putting up considerable research work, yielding results of significance with unceasing efforts and unstinted cooperation. My thanks are also due to those State Government Departments, Industries and other Agencies who evinced keen interest in the Institute's activities which included, in some cases, sponsoring of various research

schemes. I am also grateful to the Institute's Executive Council, the Scientific Sub-Committee the Building & Finance Sub-Committee and the officials of the Council of Scientific & Industrial Research for their wholehearted support to the Institute's various activities.

I like to express my sincere appreciation to Prof. S. J. Arceivala for his leadership and guidance in the activities of the Institute upto August 31, 1971.

(G. J. MOHANRAO)
Scientist-In-Charge

Nagpur :
February, 1972.

LATE SHRI N. V. MODAK

FOUNDER DIRECTOR, CPHERI, NAGPUR

(1958 - 61)

LATE SHRI N. V. MODAK

FOUNDER DIRECTOR, CPHERI, NAGPUR

(1958 - 61)

RESEARCH ACTIVITIES

(DIVISIONS AT HEADQUARTERS)

WATER

During the year a patent on " Domestic Iron Removal Unit " was filed.

1. Coagulant Aids (Natural)

The naturally designed poly-electrolytes CA–3, CA–4 and CA–5 have been found to possess good flocculation characteristics. The results of investigations on their usefulness to remove turbidity from water are interesting The effect of various factors like temperature of preparation, sequence of aid and alum addition, pH, dosages, aging, flocculation time etc. were investigated.

Pilot plant and full scale plant operations were carried out using the most promising aid CA–3. The studies carried out at Kanhan water works, have shown considerable saving in the use of alum when CA-3 is used. These aids are effective in the concentration range of 2–10 mg/l.

The prolonged use of natural coagulant aid on the treatment plant has brought out the following points :

(a) The aid cannot be used when the turbidity is lower than 300 units.

(b) A good house–keeping is necessary when the coagulant aid is used.

(c) The aid deteriorates in quality after 3 months, even after addition of high concentration of preservatives.

Further work on improving the keeping quality and extension work is in progress.

2. Coagulant Aids (Synthetic)

Synthetic coagulant aids are much more effective than natural, in that they act equally efficient at one–tenth to one–hundredth concentration of natural aids.

Two synthetic coagulant aids CA–11 and CA–12 are developed on a laboratory scale. There have been certain shortcomings, especially in solubility. Hence to overcome this problem, another Coagulant Aid, CA–15, in the form of a jelly has been developed. The results of the laboratory investigation on the use of CA–15 are presented in the table :

Raw Water Turbidity Range Units	Alum requirement without the use of CA–15, mg/l		Alum requirement with the use of CA–15 mg/l			Reduction in the alum dose from original (approximate)
	Range	Average	CA–15	Range	Avg.	
> 2000	300–400	360	2.0	50–70	60	1/5–1/6
1000–1500	150–200	170	1.5	30–50	40	1/4–1/5
500–1000	100–150	120	1.0	20–40	30	1/4–1/5
100– 500	40–100	70	0.5	15–25	20	1/2–1/5

Work is in progress to study the toxicity effects of these aids in accordance with the procedures followed by USPHS.

3. Defloridation Studies

(a) The defloridation plant at the Central Training Institute, Hyderabad was designed for about 5550 litre (25,000 gallons) per regeneration using "Defloron–2". The raw water F^- is about 3.0 3.5 mg/l About 30 cycles are so far completed and the plant has yet to attain its designed capacity.

The treated water is reported to be having a stringent taste during the initial 30 to 60 minutes of operation. The loss of the medium is about 30 gm per cycle. The total loss of medium during the 30 cycles is 9 kg which is equivalent to 15 litres. This is about 0.056 % per cycle as against an expected loss of 0.2 %. The reason for this may be the inferior coal used in bulk preparation of the medium. This problem is being investigated further.

To overcome alum feeding and preparation of alum solution, an alum pot is being fabricated and will be installed soon. This will obviate the necessity of gravity feed of alum.

(b) Removal of Fluorides by Magnesia

Work on the possibility of removal of F^- by using Magnesia bas shown that the dose of Magnesia required to remove F^- is very high. Even a dose of 1500 mg/l of Magnesia does not reduce F^- concentration in raw water (3–15 mg/l. to below 1.2 mg/l.)

(c) Defloridation Problem in Tanzania

In the Arusha region in North Tanzania ground waters have high concentration of Fluorides, ranging from 3.0 to 18.0 mg/l. The acceptable upper limit of F^- in drinking water is about 1.5 mg/l.

The Institute has carried out detailed investigations and a senior scientist was deputed to Tanzania to collect "on-the-spot" data and recommend the most suitable type of plant.

The proposed plant, consisting of a pressure type M. S. shell with all the necessary accessories has been designed by the Institute. The average F^- concentration in the treated water would be 0.6 – 0.8 mg/l. The cost of the treatment worked out to about Rs. 0.50/m^3 of water treated.

4. Activated Silica

Activated silica is a colloidal silica solution used in water treatment as a coagulant aid, usually in conjunction with aluminium sulphate. It improves the floc size and density. Not much information is available as regards its preparation and suitability for use under Indian condition. Its use in low turbid waters in India particularly in winter period is not known. Laboratory studies using various types of activants have been completed and the product thus developed is under field trials.

5. Iron & Manganese Removal

The Domestic Iron & Manganese Removal (DIRU) Unit developed by the Institute was put to field trials to gain experience in operational and other associated problems. Extension work in the field is in progress

6. Reverse Osmosis

The investigation aims at developing suitable membranes for desalination of water. There are vast areas in the country where brackish waters are available and which need suitable treatment. Studies so far carried out indicate that cellulose acetate was found to be the most suitable material for membrane due to its preferential absorption of water from aqueous salt solution.

A design has been prepared for a batch testing unit to hold membranes. Attempts are being made to prepare the unit out of brass. Work on this project is being continued to perfect the technique.

SEWAGE

The emphasis of investigations by this division has been on evaluation of low cost wastewater treatment methods and utilisation of effluents. The activities are grouped in two cells which are described below :

SEWAGE TREATMENT AND UTILISATION CELL

1. Stabilisation Ponds

Study on delineation of mechanisms of stabilisation of organic matter in facultative ponds was completed. Figure 1 shows the extent of anaerobic reactions at different loadings. Even at higher loadings the pond could be operated under nuisance free condition. New pilot stabilisation ponds are under construction where the effect of depth on performance of facultative ponds and anaerobic ponds will be studied.

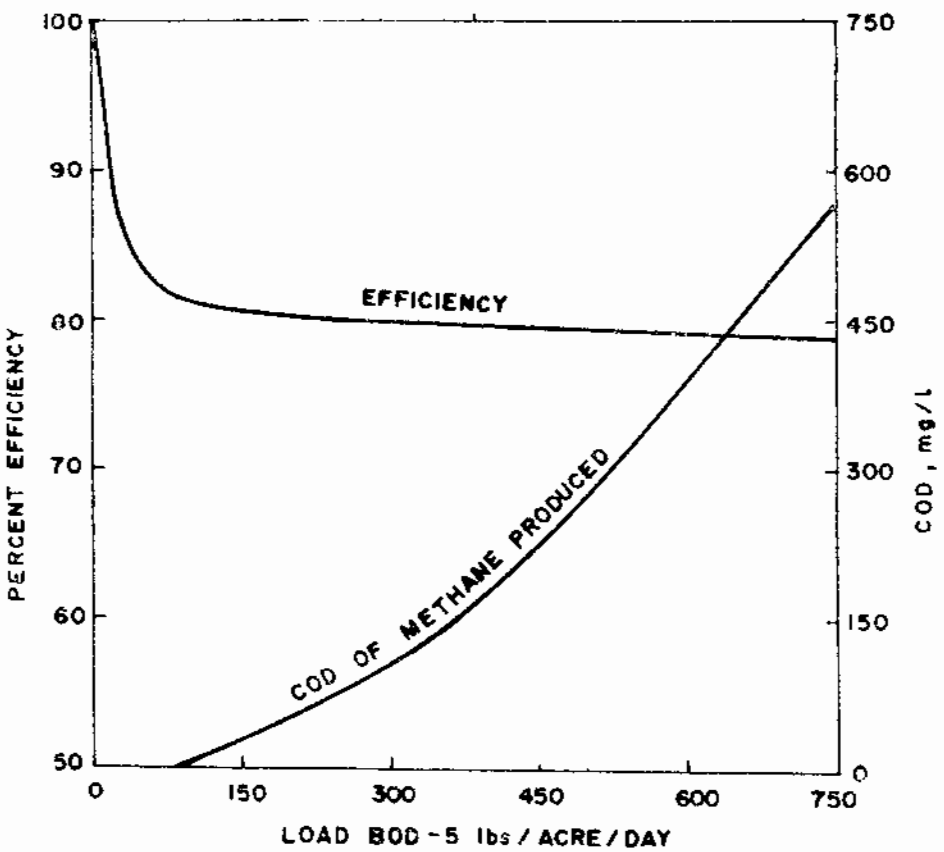


Fig. 1–Efficiency and Methane Production at Different Loading Rates

2. Extended Aeration Systems

Studies on pilot plant aerated lagoon and oxidation ditch were completed. Figure 2 shows the quantity and quality of excess sludge produced in these systems at different sludge

retention times, when treating domestic waste. Based on this data it was concluded that in warm climates the extended aeration systems may be designed to have lower sludge retention time as compared to systems in cold climates.

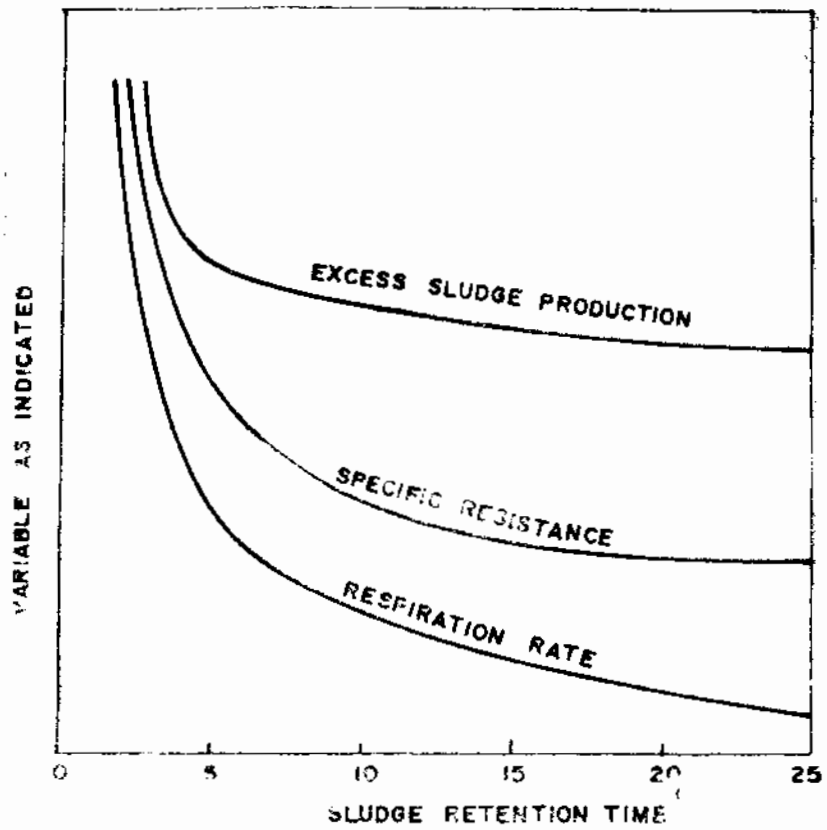


Fig. 2–Quantity and Quality of Sludge As a Function of SRT.

3. Oxygenation Capacity of Aerators

Studies were completed on characterisation of a 3 ft. (0.91m) diameter aerator at different speeds and immersions in the institute's 50,000 gallon (227.3 m^3) capacity pilot plant. Studies including characterisation of units of larger diameter requiring upto 25 horse-power (18.6 kilowatt) and laboratory bench scale studies are being planned.

Photo showing collection of sample of sewage from oxidation ponds.

A view showing floating aerator in action in the pilot plant aerated lagoon.

4. Biological Disc

The process combines settling and digestion as in Imhoff tank, but with aerobic stabilisation of non-settleable and dissolved organic matter by biological slime growing on discs rotating within the settling compartment. Studies on a bench scale model were completed in the previous year. Construction of a pilot plant having fifty discs of eight feet diameter was completed. It is now planned to collect operational data of the plant at different loadings.

5. Anaerobic Contact Filter

Laboratory studies on the performance of anaerobic contact filter treating domestic waste were initiated. Construction of a field unit has been completed and will be put into operation for further studies.

6. Sewage Irrigation

Field experiments were continued using differentially diluted raw sewage and treated effluent, with and without fortification with fertilizers, as irrigants. A new plot was developed and field variability tests were carried out.

7. Some Characteristics of Municipal Sewages in India

There are more than 132 sewage farms in the country covering approximately 12,000 hectares. Almost all of these farms use raw sewage as irrigant. In order to make an optimum use of the nutrients present in sewage, a knowledge of their concentrations in the irrigant is helpful. With this aim, CPHERI laboratories analysed sewages from eight cities of the country in three seasons during 1970-71 for concentrations of the major plant nutrients N, P and K. Information was also collected regarding concentration of alkyl benzene sulphonate (ABS), which causes foaming and is reported to be detrimental to some plants if present in high concentrations. Concentration of ABS was found to be quite low. The data obtained is summarised in the following table :

NITROGEN, PHOSPHOROUS, POTASSIUM AND ALKYL BENZENE SULPHONATE CONCENTRATION IN MUNICIPAL RAW SEWAGE OF VARIOUS CITIES IN INDIA, AVERAGE OF THREE SEASONS 1970–71 EXPRESSED IN MG/1

Sl. No.	Place	N	PO_4	K	ABS
1	Delhi	28.5	13.7	41.1	0.7
2	Calcutta				
	A : Palmer Bridge	40.6	5.6	16.0	0.1
	B : Ballygunge	41.0	4.5	18.4	0.2
3	Madras	59.0	25.3	19.2	0.7
4	Bombay	47.7	12.3	—	—
5	Hyderabad	37.0	14.8	26.0	—
6	Kanpur	73.9	2.5	6.8	1.6
7	Jaipur				
	A : Northern Farm	100.0	26.0	39.0	0.2
	B : Southern Farm	72.0	24.0	29.0	0.2
8	Nagpur	58.3	7.2	41.7	1.2

-- not determined

BIOLOGY CELL

1. Pisciculture in Stabilisation Pond Effluents

Observations were carried out on the growth of *Cyprinus carpio* in culture ponds receiving differentially diluted effluent from a stabilisation pond. Figure 3 shows the pattern of growth in these ponds. Maximum yield among the dilutions studied was obtained in the pond receiving fresh water and effluent in the ratio of 1 : 2 Studies were also started on growth of the fish in five ponds in series with the stabilisation pond without receiving any dilution water.

2 Health Status of Sewage Farm Workers

Sewage farm workers at four farms in the country and control groups were examined clinically. Their stool samples were examined for parasitic, helminthic and protozoan infections. Incidence of disease and multiplicity of infection was significantly higher in the farm workers.

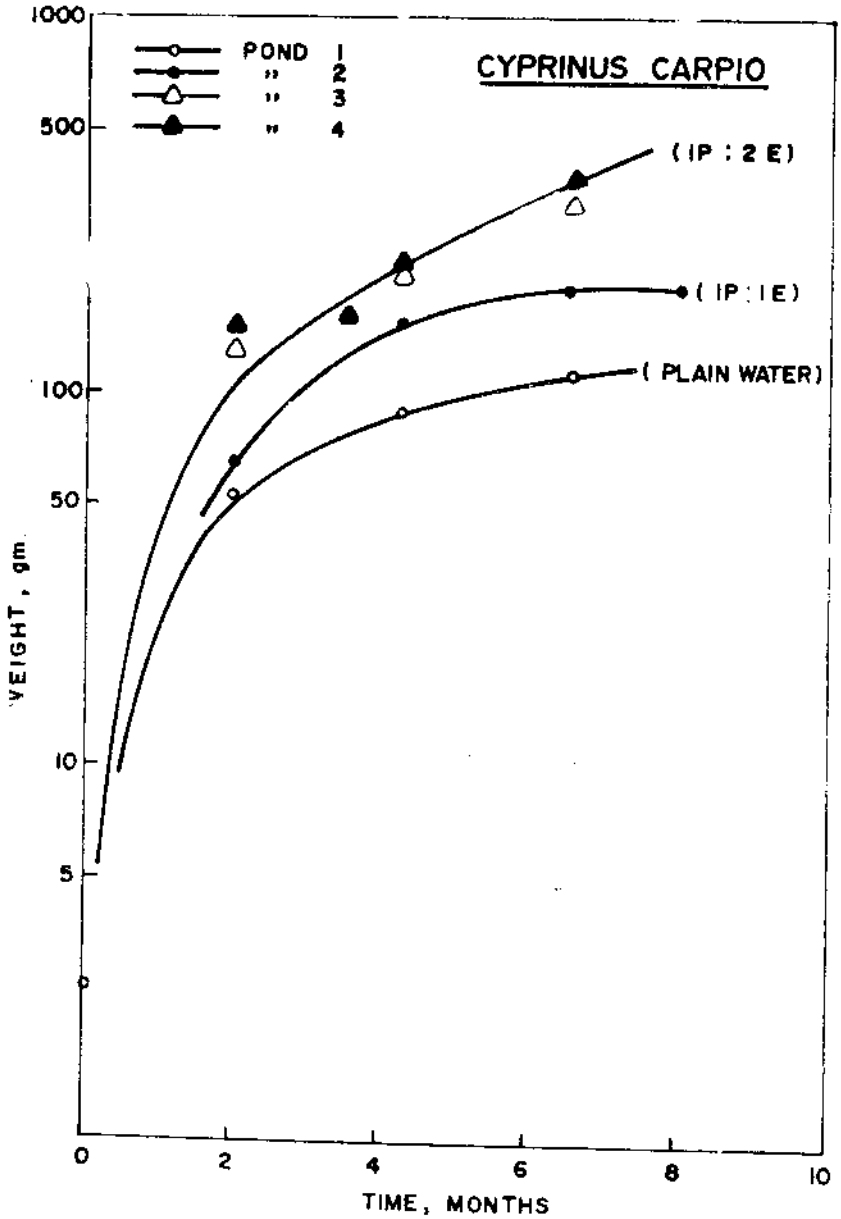


Fig. 3–Fish Culture in Stabilisation Pond Effluents, Growth Curves

3. Manual on Nuisnace Causing Organisums in Water Supplies

The project was continued from last year. More data was collected from five cities by flushing the distribution mains. The data will be used in the preparation of the manual.

INDUSTRIAL WASTES

1. Pulp and Paper Mill Effluents

a) Orient Paper Mills, Amlai, M. P.

Results of anaerobic lagoon pilot plant studies with nutrient addition have shown that for pulp mill effluent, a BOD reduction of 67% and 50% is achieved in summer and winter, respectively, at 10 days detention time. Anaerobic lagoon operated without addition of nutrients showed that if the detention time is maintained at 20 days, the BOD reduction varied from 45% to 65%. This observation has a profound influence in reducing the running cost in the treatment of pulp and paper mill wastes A full scale anaerobic lagoon of 80 MG capacity for treating 4 MGD of waste is being developed.

Aerated lagoon pilot plant for treating anaerobic lagoon effluent has been set up and the experiments carried out so far indicate that the BOD in anaerobic lagoon effluent can be further reduced to 15–20 mg/l at a detention time of 3 days.

b) Newsprint Factory, Nepanagar

Anaerobic lagoon studies on the effluents from Nepa Mills revealed that the BOD of the wastes could be brought down to 30 mg/l even at a detention time 1.6 days. Aerated lagoon studies showed that the BOD in the waste could be reduced to 10 mg/l (settled BOD) even at a detention time of 1 day. Based on these studies, 4 alternative flow sheets have been suggested to the factory. The factory is now setting up Anaerobic–Aerobic Lagoon System for treating 1 MG of waste/day on a pilot scale. A report on the above studies has been prepared and submitted to the factory authorities.

c) Removal of Colour from Paper Mill Effluents by using Fungi

Laboratory investigations are in progress to determine the efficiency of the fungi namely *Polyporus versicolor* and *Fomes fomentarius* in removing colour due to lignin from pulp mill effluents. These fungi are terrestrial in their habit. However, they could be grown in liquid media and are able to decolourise liquid malt extract. Experiments are in progress in growing these fungi in media containing lignin.

2. Rayon Pulp Mill Wastes

a) Gawlior Rayons, Mavoor

Large scale anaerobic lagoon (3 numbers) with a total liquid capacity of 45,000 M^3 have been constructed for treating the prehydrolysate (P. H.) liquor and wash at the factory site. These are being operated presently for treating 400 M^3 of P. H. liquor. Lagoon No. 1 alone is found to remove over 90% BOD from the waste. The other two lagoons are being seeded and will be commissioned to take the remaining wastes.

Treatment of anaerobic lagoon effluent in aerated lagoon system in the laboratory showed that with a detention time of about 5 days the BOD can be brought down to 300–400 mg/l from an initial value of 3000-4000 mg/l. Pilot plant aerated lagoon (1500 M^3) is being operated for field trials.

b) Utilisation of Prehydrolysate Wastes

Laboratory studies on the utilisation of the P. H. liquor for growing yeast revealed that 8 – 10 gms of yeast could be recovered/liter of P. H. liquor. The optimum environmental conditions required have been worked out. The growing of yeast has effected a 50 % reduction in the BOD of the waste. The process is being patented. A pilot plant for producing yeast on a semi-large scale is being set up at the factory site.

3. a) Petrochemical Wastes

Treatment of wastes from Aromatic Project of Indian Petrochemicals Corporation Ltd. has been worked out on simulated waste prepared in the Laboratory, as per the composition given by the factory authorities. Laboratory activated sludge studies revealed that the waste is biodegradable by acclimatised activated sludge yielding over 90% reduction. Aerated lagoon system 'k' was also determined in laboratory. Based on this study, 5 alternative flow sheets have been suggested and a report submitted to factory authorities. A treatment plant is being built on the basis of the above work.

b) Treatment and Utilisation of Distillery Wastes

A report has been compiled from the information obtained from 36 distilleries in India indicating raw materials, products manufacture, wastes obtained, disposal and treatment of

effluent. Experiments are in progress in preparing animal feeds by mixing disillery spent wash as such and the concentrated, with materials like jawar straw, wheat straw and rice bran. The keeping quality of these materials is being tested.

c) Synthetic Drug Wastes, Hyderabad

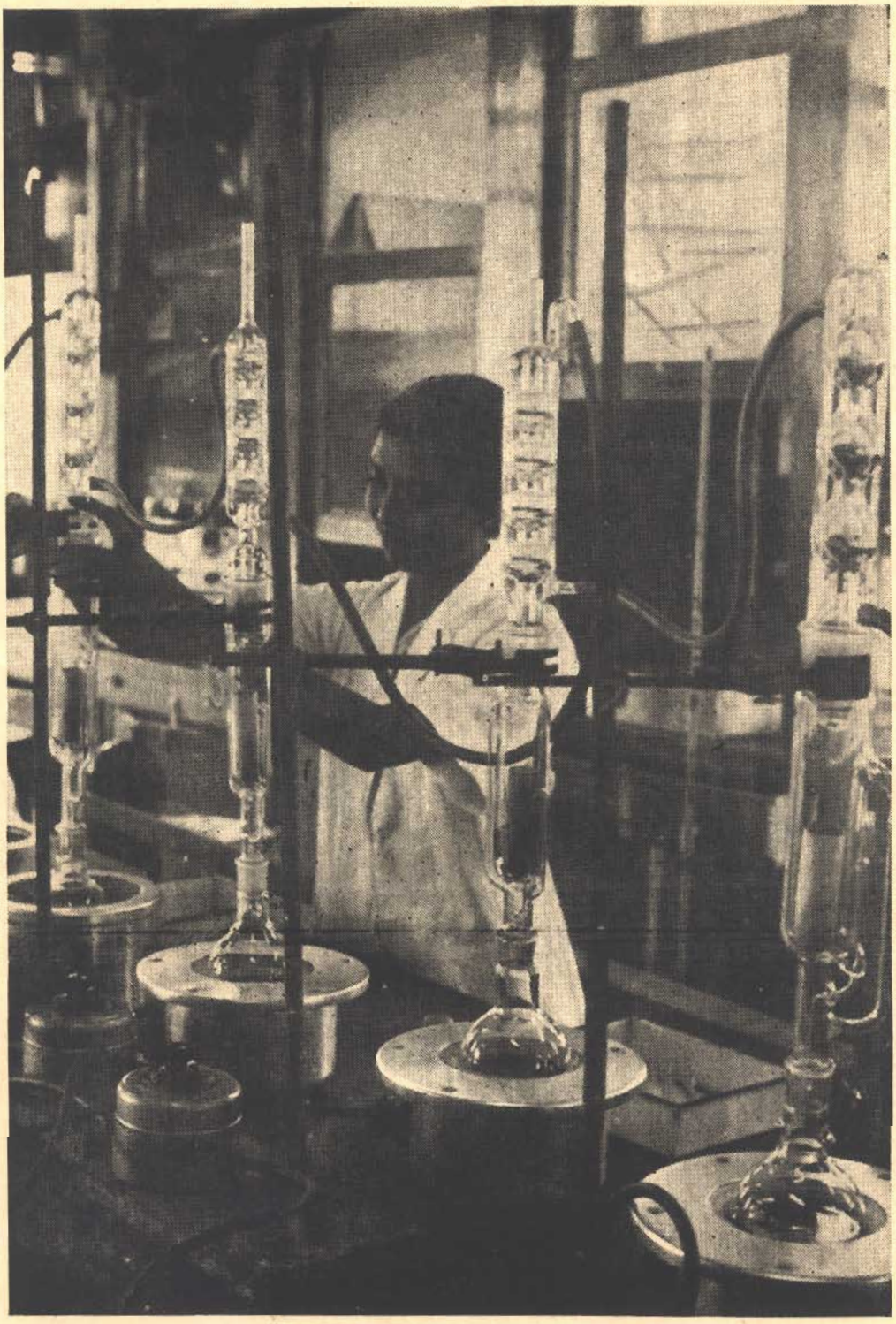
Work was undertaken at the repuest of the factory authorities to study the existing treatment plant and to study additional treatment plant that will be needed for the treatment of wastes from future expansion. Loboratory studies on the existing wastes employing aerated lagoon system indicated that the combined waste can be successfully treated yielding an effluent of less than 10 mg/l BOD. The laboratory studies indicated that the system 'k' was 0.183. Based on these studies, an aerated lagoon is being set up at the factory for treatment of 2 lakh gpd of waste on a pilot scale.

AIR POLLUTION & INDUSTRIAL HYGIENE

1. National Air Sampling Network

This project has been started in 1969–70 primarily with a view to collect air quality data with reference to atmospheric pollution caused by industrial and domestic emissions which will eventually lead to the preparation of air quality standards under Indian conditions. The network has been spread out all over the country. The different selected cities together with their classification are given below :

City	Type
Bombay	Heavily Industrial
Calcutta	-do-
Delhi	Commercial
Madras	Industrial
Kanpur	-do-
Ahmedabad	Heavily Industrial
Hyderabad	Commercial & Industrial
Jaipur	-do-
Nagpur	-do-



A worker in the Air Pollution Division conducting analysis of air samples.

The Common parameters under study are :

i) Gaseous pollutants – SO_2, NO_2, H_2S

ii) Suspended particulates

iii) Sulfation rate

iv) Dust fall

The data for the year 1970 have been compiled and similar data have been collected for the year 1971 from the above cities (Table II). A few more cities are being added and the same programme will be continued in collaboration with the Engineering Colleges located in the respective cities.

TABLE II-AIR QUALITY DATA FOR THE YEAR 1970–71

Sulphur dioxide $\mu g/m^3$

Station	Annual mean		Standard Geometric Deviation	Maximum during the year	
	Arithmetic mean	Geometric mean		Maximum monthly arithmetic mean	Maximum 24-hr arithmetic mean
Ahmedabad	10.7	5.9	4.2	20.0	27.5
Bombay	47.1	30.4	2.8	150.5	190.0
Calcutta	32.9	17.6	3.5	113.0	171.5
Delhi	41.4	21.6	3.1	143.0	283.9
Hyderabad	5.1	4.2	3.2	6.6	8.0
Jaipur	4.2	3.0	3.3	7.0	7.0
Kanpur	12.0	9.3	2.1	20.3	31.0
Madras	8.4	7.4	1.7	7.2	17.0
Nagpur	7.7	5.8	2.4	13.3	20.5

The Institute undertakes city air pollution surveys upon request. This service is rendered as a continued activity to motivate city authorities to watch and curb air pollution in the city.

2. City Air Pollution Surveys

Following organisations have already sponsored the projects for conducting air pollution surveys in their respective regions. The execution of project work has been started as shown in following table :

Sl. No.	Sponsoring Authority	Project Area	Survey Period
I.	Bombay Municipal Corporation	Greater Bombay	Oct 1970 to Oct.1973
II.	CIDCO	New Bombay	Nov. 1970 to April 1971 & Nov. 1971 to Nov. 1973.
III.	Calcutta Metropolitan Devlopment Authority has accepted the Institute's proposal for the city air pollution survey which will be carried out for a period of 3 years. The work will be commenced soon after completing the necessary formalities.		

3. Sponsored Industrial Air Pollution Surveys

During the year, various industries have approached the Institute for assessing the atmospheric pollution caused due to Industrial emissions and to take control measures in future. This Work also forms a continued activity of the Institute.

A short term survey for a period of 10 days was undertaken for each industry listed below to study the nature and extent of the air pollution problem. The reports were submitted to the sponsors with recommendations for control measures.

Industry	Nature of Problem
i) Hindustan Aeronautics Ltd. Hyderbad	Air quality survey with resspect to SO_2 total acidity, total oxidants, H_2S, phenols and suspended particulates.
ii) Central Railway, Bombay	Air quality survey for SO_2, Cl_2 and H_2S and consequent heavy corrosion of railway property.

Industry	Nature of Problem
iii) ACC Bulk Cement Distribution Depot, Okhla, Delhi.	Cement dust in the neighbouring region causing pollution.
iv) Fertiliser Industries at Madras.	SO_2 and fluoride emissions and their pollutional effects in the neighbourhood.
v) Bagalkot Udyog Ltd., Bagalkot Distt. Bijapur, Mysore State	Cement dust causing pollution in the township–A preliminary Survey.
vi) Navin Flourine Industry, Bhestan, Surat.	SO_2, SO_3 and fluoride emissions and their pollutional effects in the surroundings.

There are a few more surveys on hand with the Institute to be taken up shortly.

4. WHO Regional Reference Centre

The Institute has entered in 2nd year of its working as WHO Regional Reference Center (RRC) for air pollution. This Institute has been designated as RRC in air pollution since 1969. The first year report on the progress of the work giving details of air quality for different cities in the couutry has been submitted to the World Health Organisation.

5. Development of Analytical Techniques

Following methods are under study to adopt them suitably for the purpose of air monitoring studies :

(i) Turbidimetric method for determination of sulfation rate;

(ii) Total acidity in the atmosphere;

(iii) Estimation of Benzapyrene;

(iv) Sampling and Analysis of Acrolein; and

(v) Sampling and Analysis of SO_2 from stacks

6. Development and Fabrication of Equipment

The following equipments have been developed for use in air quality survey programme (i) A sampler for suspended particulates; (ii) Standardization of Wind Speed and Direction Recorders fabricated by this Institute; and (iii) Sampling Kit for simultaneous Sampling of different gaseous pollutants.

7. Automobile Exhaust and Air Pollution

A rapid survey was undertaken during 1970 in order to study the auto-exhaust from Gasoline Engines. A report of this survey has been published in CPHERI Technical Digest No. 6 (June 1970). A more exhaustive study for different pollutants from the exhaust is in progress.

MICROBIOLOGY

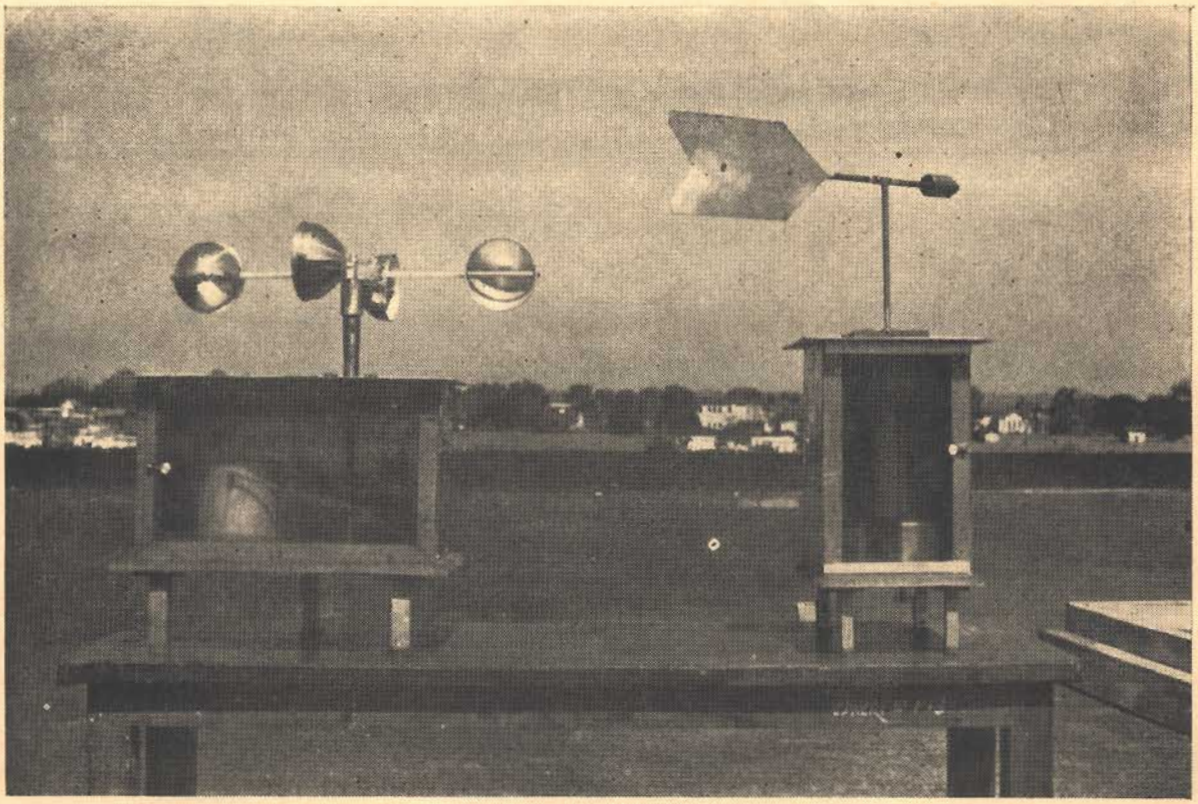
(INCLUDING VIROLOGY)

1. Die-away of bacterial pathogens and parasites in different sewage treatment plants

Investigations were continued on the performance of pilot plants like oxidation pond (single cell), oxidation ditch and aerated lagoon situated in the CPHERI campus for the elimination of bacterial pathogens and insestinal parasites. The studies showed that there is a considerable reduction in *Salmonella* and intestinal parasites during the treatment processes, though they were not completely removed.

The number of salmonella in the influent varied from 50 to 1610 organisms for oxidation pond, 50 to 3500 organisms for oxidation ditch and from 130 to 7000 organisms for aerated lagoon per litre. The effluent count ranged from 10 to 193 organisms for oxidation pond, from 2 to 490 for oxidation ditch and from 6 to 66 organisms for aerated lagoon per litre.

The work on the performance of oxidation ponds at Bhilai and Bhandak showed that in these ponds (which have one or two cells), the *Salmonella* were always less than 10 per litre of



Left : An Apparatus for Recording Wind Velocity
Right : An Apparatus for Recording Wind Direction

effluent. The effluent showed great reduction of parasites in the oxidation pond at Bhandak, while at Bhilai there were no intestinal parasites even in 2 litres of the sample.

2. Development of a synthetic medium for bacteriological analyses of water

The work to formulate a chemically defined medium using ammonium salts as major source of nitrogen and comparing it with the McConkey broth was completed.

In all 354 water samples obtained from different sources *viz.* lakes, rivers, wells and treatment plants having different pollutional loads were analysed simultaneously by both media, i. e., Synthetic and McConkey and the advantages of the former have been recorded.

3. Use of soil cultures for the biological treatment of wastes

Work has been initiated by isolating micro-organisms from soils for treatment of certain toxic industrial wastes by these cultures. Work on a variety of industrial wastes containing cyanides, phenols, pharmaceuticals and others has been investigated and the results are encouraging. Further work is in progress.

4. Development of suitable medium to replace the imported and dehydrated medium for Millipore Filter

The Institute has developed membrane filters for bacteriological analysis of water. The medium used for these is usually an imported one. Hence attempts are being made to develop indigenous medium which will be cheaper and easily available. The results of preliminary studies are encouraging. Furthere work is in progress.

5. Public Health Aspects of Sewage Farming

Studies are being carried out to investigate the presence of helminthic eggs, protozoan cysts and enteric bacterial pathogens like *Salmonella* and also Coliforms and Fecal streptococci

on crops and vegetables grown under sewage irrigation. Weekly Samples are collected and analysed. From five sewage farms at Nagpur, a variety of vegetables like Tomato, Palak, Coriander, Thurai, Radish, Brinjal, Cauliflower, Pudeena, Kakadi and Solgam were so far examined and none of them showed parasites or *Salmonella* although the raw sewage which was used for irrigation was always positive for *Salmonella* and parasites. But all of them showed the presence of Coliforms and Fecal streptococci.

6. Improved techniques for virus concentration from sewage

The improved method was tested by monitoring raw sewage for its viral content from a middle income group community in Nagpur over a period of twelve months. Human enteric viruses were found in the range of 1075–11, 575 PFU (Plaque Forming Units) per litre.

Samples of raw sewage from Bhilai and Bhandak were also examined. Virus was detected in the range of 117–1675 PFU/litre. The method was also used in field trials for examining effluents from two pilot plants *viz.*, aerated lagoon and oxidation ditch at the Institute and 2 full-scale oxidation ponds, one located at Bhilai and the other at Bhandak. The effuents, in general, were found to contain virus.

7. Bacteriophage Model Studies for the Concentration of Viruses from polluted soils

The two step concentration procedure by centrifugation could handle only small quantities (5 gms) of soil samples. High speed centrifugation may not be feasible in all laboratories. As such, an alternative procedure need be developed to handle larger amount of samples. After removing the coarse particulate matter from the aqueous soil extract by centrifugation at low speed of 2500–3000 rpm, the suspension containing phage alongwith the colloidal matter is flocculated with alum. It was observed that 99.4 to 100 percent phage could be trapped in the flocs. The desorption of the phage from the flocs by using a suitable eluant is being studied at present.

8. Virus removal in different sewage treatment (pilot) plants

Studies regarding virus removal in two different pilot plants *viz.*, oxidation ditch and aerated lagoon have been carried out covering a period of one year. Density of viruses (PFU) obtained in one litre volume of effluent showed 3–90 in oxidation ditch and 25–376 in aerated

A typical village scene around the traditional well which is disinfected by the single pot technique.

lagoon. The corresponding percentage reduction of viruses was 96.0–99.9 in oxidation ditch and 76.0–99.9 in aerated lagoon. Two full-scale oxidation ponds one at Bhilai and the other at Bhandak have also been evaluated for their performance. Effluent from Bhandak showed 5–50 and that of Bhilai 6–12 PFU/litre and the percentage reduction of viruses in these ponds was between 93 and 97.

ENGINEERING

1. Water Filtration

(a) Suitability tests on indigenous bituminous coal samples as a substitute media for anthracite for use in two-layer filters were completed and the results published in the form of a Technical Digest (No. 18) which received quite a good response from field engineers. Information on technical details was supplied to corporations and municipalities for proposed conversion of existing rapid sand filters into high rate two-layer filters.

(b) As a part of the extension work on filtration project, Umrer Water Supply Scheme which was referred to CPHERI by the Govt. of Maharashtra was studied in detail with a view to suggest the most suitable and economic treatment method. Alternatives other than the originally proposed conventional treatment were investigated, the capital and running costs were worked out for each of the alternatives and a report incorporating the recommendations was sent to the Department. Based on the report the Department has decided to go in for slow sand filtration. Further assistance as required for necessary follow-up action is being extended by CPHERI.

(c) Studies have been initiated to assess the performance of a roughing filiter consiting of a deeper sand bed of coarse grains without addition of any coagulant to the raw water. The study with raw water having a turbidity in the range of 100–500 units is in progress.

2. Leaching of toxic lead stabiliser from uPVC pipes used for potable water supply

The levels of extraction of lead stabiliser from samples of uPVC pipes manufactured in the country have been studied as per the procedure laid down by ISI. A few pieces of imported pipe samples have also been tested. The pattern of lead leaching from uPVC pipes with flowing and standing water has also been studied and the results are being analysed.

3. Development of a field flush latrine

Work was continued on the project and a private firm has been entrusted with the work of fabricating a prototype field flush latrine out of reinforced plastic as per the improved design The prototype will be tested for performance requirements by CPHERI before going in for. large scale use of these units.

4. Brochure on 'Plastics Pipes in Water Supply & Drainage.'

With a view to guide engineers, architects, plumbers and others concerned in the proper selection, installation and use of plastic pipes a draft brochure describing the process of manufacture, general characteristics and choice of the material, recommendations for laying and jointing etc., has been prepared and circulated widely among experts in the field for their comments. The draft is being finalised for publication after compiling and studying the comments received.

SOLID WASTES DISPOSAL

1. Collection of data about quality and quantity of refuse from four Indian Cities

Work on this project was continued during the year. As some of the cities which were taken up last year would be studied in more details under PL-480 project (Sl. No. 2 below), the number of cities to be covered in this project has been reduced to four.

With a view to strengthen this work at the Zonal laboratories, teams from this division visited Bombay and Delhi, collected and analysed 107 and 84 samples respectively.

2. Solid Wastes in India

This project is being financed from PL-480 funds. The data collected so far about refuse characteristics are given in Table III. It is proposed to collect additional data about

TABLE III – SOME PHYSICAL AND CHEMICAL CHARACTERISTICS OF CITY REFUSE

Item	Bombay (107 samples)	Calcutta (308 samples)	Delhi (84 samples)	Hyderabad (56 samples)	Jaipur (20 samples)	Kanpur (30 samples)	Nagpur (20 samples)
Garbage	52.3	45.1	23.5	28.1	22.2	35.8	31.4
Paper	12.6	3.2	7.2	5.7	1.1	4.5	0.2
Glass	1.5	0.4	1.3	1.1	1.0	1.0	0.1
Rags	4.7	3.6	5.5	3.4	3.5	5.7	0.3
Plastics	2.7	0.6	1.5	—	0.7	0.8	0.1
Metals	1.2	0.7	1.3	1.9	0.8	0.8	0.9
Moisture	46.0	41.1	27.4	28.6	12.8	23.4	18.0
C	31.4	19.3	13.6	37.5	9.4	14.4	18.8
N	0.7	0.6	0.5	0.9	0.8	0.6	0.4
P_2O_5	0.6	0.6	0.6	0.4	0.4	0.6	0.3
K_2O	0.8	0.4	0.5	0.7	—	0.1	0.6
L. C. V. K Cal/kg	2197.6	1260	1030.6	2774.7	—	958.1	1360.0
Density kg/cum	264.8	470	457.1	394.6	493.5	622.5	500.0
Per Capita kg/day	0.5	0.6	—	0.2	—	0.4	0.3

Note : 1. Physicale analysis are given on wet weight basis.

2. Chemical analysis are given on dry weight basis.

3. All values are given in percentages, except LCV, Density and Per Capita value.

quality and quantity of refuse from twelve cities scattered all over India covering all variations in climatic conditions & dietary habits. Preliminary planning with the aid of a questionnaire has already been completed and the field work has been started.

3. Comparative Study of Windrow method of Composting of City Refuse

Presently the studies are being carried out to find out the effect of segregation and shredding on composting in pits. Regular samples are being collected and analysed.

4. Characterisation of Leachates from refuse dumps & sanitary landfills

Laboratory studies have been carried out to find out the major characteristics of leachates from refuse mass. To study the effect of decomposition on variation in characteristics, samples in fresh, under active decomposition and after complete decomposition were examined and the characteristics were found to be different in these cases. To study the effect of ground water on characteristics and the quantity of leachates, a model is being fabricated.

5. Collection of Data regarding transport and disposal of refuse from Nine Indian Cities

At Calcutta, the cost of transport of refuse was found to be Rs. 1.15 per Km per ton while the cost of disposal ranged from Rs. 1.79 per ton to Rs. 14.14 per ton at various disposal sites. Data from the other cities are being similarly collected and analysed.

6. Feasibility studies on refuse collection and disposal from Howrah City

At the request of the Calcutta Metropolitan Development Authority (CMDA), the Institute has recently started work on sampling and analysis of refuse from Howrah city and the relevant data on the transport and disposal system is being collected.

WATER POLLUTION SURVEILLANCE

1. To study concentration of organics in waters using carbon chloroform extraction method

Certain organics such as pesticides, insecticides, herbicides have been known to pass through the conventional water treatment units. The use of these chemicals has increased in India and the adverse effects of these chemicals on human metabolism are now fairly known and hence their level in treated water is of public health importance. Work on this project has been planned and 4 – 6 river water supplies are being selected for investigation. An activated carbon column for absorption of organics has been fabricated and the method is being tested.

2. Baseline studies of water quality of Hooghly River

The river Hooghly passes through the heart of Calcutta and its water quality will be of prime importance for the development of urban and industrial centres in the region. At the request of CMDA, the Institute has undertaken a water quality study of the river through its Calcutta Zonal Laboratory.

3. Model study on river pollution

River Gomti was surveyed in a 13 mile stretch of Lucknow region in the year 1960-61. A more intensive investigation is being conducted through the Institute's Kanpur Zonal Laboratory.

RURAL SANITATION

During the year, the Division participated in the Survery on Health status of Sewage Farm Workers. Refuse Workers from Nagpur, Trivendrum and Sewage Farm Workers from Trivandrum were examined to assess health hazards to which they are exposed.

Digestion of Night Soil and other Refuse

Pilot plant study on night soil digestion revealed that night soil can be digested without any fly or odour nuisance in an unheated open masonry tank with a volatile solids loading of 0.13 lb/cft/d and a detention time of 25 days. Further, it was observed that night soil has to be diluted with water or sullage to reduce the solid contents to below 8% and preferably to 5%. At this loading 1 cft of digester space per head was required. Laboratory experiments were carried out to overcome the ammonia toxicity effect noticed in night soil digester at higher loadings, by mixing cow dung with night soil. It was observed that 1 part of cow dung and 3 parts of night soil could suppress ammonia toxicity effectively. The project was completed and the information is being disseminated to interested parties.

Other activities of the Division comprised mainly of extension work to popularise inexpensive rural sanitary wares like Drip chlorinator, Wash Basin, Dust Bin, Earthen pots for disinfection of water and arrange model layouts such as of a soak pit for demonstration. During the year, demonstrations on rural santaition were arranged for students of Medical College, Nagpur, Mahatma Gandhi College of Medical Sciences, Sewagram and Corporation Medical College, Nagpur, Health School, Nagpur and VRCE, Nagpur. The Institute is helping the village Shivangaon (near Nagpur Airport) in its sanitation.

INSTRUMENTATION

The Division, as one of its continued activities, looked after maintenance, service and repairs of equipment of the Institute including sophisticated ones received under the UNDP Assistance. In addition, developmental work has been undertaken on the design and fabrication of equipment/gadgets as needed for research work, instrumental analysis and modifications in the existing imported equipment to suit the use of indigenously prepared spares.

Developmental work was continued on Electronic/electrical network analyser.

"CPHERI-Chloroscope" has been manufactured and is being sold.

Facilities for instrumental analyses such as infra-red spectrophotometry have been extended to many outside organisations. Similarly, many research/educational institutions have been extended help through inspection and repairs to their instruments.

ZONAL LABORATORIES

ZONAL LABORATORIES

Besides the research projects that are listed under each Zonal Laboratory separately, these laboratories continued to collect and supply data on :

(i) long-term city air quality surveys of the respective cities.

(ii) quality and quantity of city refuse, and

(iii) survey of the existing sewage treatment plants with a view to develop design criteria for different treatment processes under Indian conditions.

AHMEDABAD

1. Characterisation and Treatment of Industrial Wastes

The Zonal laboratory continued to work on the treatment and disposal of following industrial wastes. The efficiency of the treatment methods already developed by the Institute is being studied in each of the following cases : Textile, Pulp & Paper, Dairy and Chemicals & Fertiliser.

2. Air Pollution Survey

One sampling station has been established and regular samples are being collected and analysed. The data collected so far indicate that the gaseous pollution is very low in the centre of the city even during winter season when the direction of the prevailing winds is expected to bring the pollutants from the industrial zone in the east to the sampling station.

Two more sampling stations are being set up and the studies will be continued as a part of the National Air Sampling Network.

3. Characterisation of Refuse

A preliminary survey to assess the quantity and quality of the town refuse from the cities of Ahmedabad and Baroda has been carried out and the data are being analysed. This work is being continued so as to collect data during different seasons and from different localities as a part of the long term project on refuse disposal.

BOMBAY

1. Pilot Filtration Studies at Vaitarna

Studies were conducted to find out the advantages of dual media filtration for obtaining greater yield of finished water without having resorted to additional treatment units.

Laboratory model studies in a 6" diameter tube were conducted to arrive at the optimum design criteria for both the upflow and downflow types of sand/anthracite filters. Parameters such as loss of head at various depths, turbidities, filter runs, waste water consumption etc. The data are now being statistically analysed and processed.

2. Optimisation in the design of water filtration system

Based on the data collected last year, work on this project has been completed. After arriving at cost functions, a computer programme was drawn up and for hypothetical ranges of flow the optimum sizes and units were found out. Graphs were plotted showing cost vs. number of units for various design flows

3. Leakage Detection Studies of Bombay Water Distribution System (WHO Aided Project)

It is apprehended that nearly 30% of the water supplied to the consumer's in Bombay City goes as waste due to leaks in pipes and in consumer's premises. A systematic assessment of wastage, timely detection and prevention can go a long way in saving much of the water and reducing cost on augmentation

Electronic pipeline locator and electronic leak detector have been used to locate and align underground pipelines and valves, and locate leaks in pipes respectively. So far two zones i. e. Chembur and Bandra Road Areas have been surveyed. Further work in other selected zones is in progress.

4. Study of Sewage Treatment Plants in Bombay

The aim of this project was to study the effect of overloading on the performance of circular sedimentation tanks for which purpose the sewage treatment units at Colaba and Dadar were selected. Samples were collected every 24 hr and analysed for BOD, Total solids, COD and Suspended solids. The flows were adjusted at steps of 0.5 MGD upto a value of 50% in excess of the designed value. The results have been graphically presented for possible use in designing these units.

5. Bombay's Water Supply and Sewerage Augmentation Project

The waters from the existing major sources, i. e., Tansa and Vaitarna reservoirs are merely chlorinated and supplied to the consumers. Bhatsai River is contemplated as the source for additional water. Regular collection and analysis of water samples from the source have been carried out every day during the monsoon period (June to October 1970) and once a week during the other months to help design the water treatment plant including coagulation and filtration to avoid turbidity in finished water during monsoon. The data collected so far indicate that only for about 20 days in a year, the turbidity is high, while during the rest of the period it is below 20 mg/1.

Coagulation with alum is necessary during monsoon as mere settling does not remove fine and colloidal turbidity present in the waters. Further work on these lines is in progress so as to cover other seasons of the year.

6 Hydrographic Survey of Sea off the Bombay Coast

Surveys were conducted to collect data on drift, surface and sub-surface currents, salinity, temperature, depth and bottom conditions etc. of the sea off Bombay Coast with a view to find suitability and the necessary design criteria for marine disposal of sewage.

Studies were carried out 5 days in a month, with the help of a powered fishing launch at the proposed outfall points at Marua, Bandra, Worli and Malbar point. Floats were released at points 1 mile and 3 miles off the shore at these points and their paths were traced for about 6-8 hrs. General hydrographic survey was also done taking current measurements throughout the period of the tidal cycle. Temperature and salinity at various depths were also noted. Echo-sounding surveys along the outfall lines were also carried out. These surveys were helpful in deciding the length of the sewage outfall to be used.

7. Air Pollution Studies

(a) Air Quality Monitoring

At the request of the Bombay Municipal Corporation, air quality monitoring stations (9 A type and 25 B type) have been fixed and regular sampling was carried out since October 1970. Type A stations consisted of sampling of gases, suspended particulate matter, sulphation rate and total dust fall and type B consisted of sulphation rate and dust fall.

Based on the data collected so far, the extent of pollution in particular areas is being assessed and remedial measures proposed.

b) Emission Source Inventory

A list of industries within the Greater Bombay area has been prepared and classified according to the nature of pollutants emitted. A questionnaire has been prepared to determine the major emissions from different sources. To start with, Textile mills have been chosen and data are being collected which will be supported by the stack sampling technique to assess the actual pollution.

c) Auto Exhaust Emission

This study has been initiated with a view to find out the levels of gaseous pollutants such as CO, hydrocarbons and NO_2 in different conditions of vehicle movements on crowded routes. Tachograph is fitted in one of the vehicles, with a view to determine the driving cycles of the vehicles at different routes. Major routes like Worli to Bandra, Colaba, Sion, Princes Street etc. have been chosen for this purpose. The study is in progress.

8. Characterisation of Refuse

Samples are being collected regularly from dust bins from all wards in Bombay city. The areas have been classified as residential, industrial and market areas. Work on this project is being continued to cover all seasons as a part of the long term project on refuse disposal.

CALCUTTA

1. Characterisation & Treatment of Industrial Wastes

(a) Effluent disposal of M/s Tribeni Tissue Ltd., Tribeni

This survey has revealed that, despite high dilution of the effluent by the Hooghly river, the BOD, Lignin and other values of river water were higher on either side of the confluence points as compared to midstream values. The water all along the bank was highly

coloured and foam was present in plenty. The botton life also showed appreciable decrease due to pollution. Efforts are being made to treat the bleach liquor by the methods developed by the Institute.

2. Survey of Existing Sewage Treatment Plants in Eastern Region

Under this project, 3 sewage treatment plants at the following places have been studied : (a) Tata Engineering and Locomotive Co. Ltd., Jamshedpur, (b) Tata Iron & Steel Co. Ltd. Jamshedpur, and (c) Air Field, Kalaikunda.

During the survey 24 hr representative samples were collected and analysed for various items like Flow, BOD of Influent & Effluent, D. O. of the Effluent and the type of treatment given. The data are processed into a report on Sewage Treatment Plants in India.

4. Air Pollution Survey

Work on one sampling station was continued. Fortnightly samples are collected and analysed for the usual parameters.

Several more sampling stations are being established under the CMDA Project to cover other areas of the city.

5. Characteristics of Refuse

At the request of the Calcutta Municipal Corporation, the Institute has prepared a feasibility report (perhaps the first ever to be made for an Indian City) for the disposal of City refuse for Calcutta and submitted to the Corporation for implementation of the scheme.

DELHI

1. Characterisation and Treatment of Industrial Wastes

Work on the treatment of the following industrial wastes was continued :

a) M/s Mohan Meakin Breweries

Representative samples of the waste have been collected and analysed for its various characteristics. Based on the laboratory and pilot plant studies carried out by the Institute, a few alternative methods have been suggested to the authorities for adoption.

b) M/s Brooke Bond India Ltd ; Tundla

The existing disposal facilities provided by the authorities do not seem to be satisfactory. Hence detailed investigations have been made and remedial measures have been proposed.

2. Study of Sewage Treatment Plants in Delhi

Sufficient data have been collected over the past two years, on the areatment of sewage by different biological methods *viz.* trickling filters and activated sludge process. The data are being compiled in the form of a report on Sewage Treatment Plants in India.

3. Air Pollution Survey

Data so far collected from the sampling stations indicate that the suspended particulate matter was highest during the summer (April to early July) due to dust.

4. Air Pollution in the A. C. C. Delivery Depot, New Delhi

The ACC Depot receives about 12 wagons of cement per day from the manufacturing works and is unloaded and conveyed by means of conduits to silos and hoppers.

High volume samplers were installed for collection of samples at 2-3 points within the depot as well as in the surrounding areas such as the CRRI and Glaxo laboratory. The studies carried out have revealed that the pollution of air caused by ACC factory is negligible and is not a health hazard or a source of nuisance to the surrounding areas.

5. City Refuse Characterisation

So far nearly 100 samples of city refuse from different areas have been collected and analysed for their physico-chemical characteristics as a part of the National Solid Waste Characterisation Programme.

HYDERABAD

1. Characterisation and Treatment of Industrial Wastes

a) Treatment of wastes from the Synthetic Drugs Factory

Work on the installation of floating mechanical acrators in one of the balancing tanks is in progress. Necessary design, flow-sheets have been provided to the factory authorities and one aerator was installed. Study on this aerated lagoon is in progress.

b) M/s Warner Hindustan Ltd.

Work on the characterisation of the wastes from this factory has been completed and a project report has been prepared.

2. Defloridation Plant at the Central Training Institute, Hyderabad

A full scale defloridation plant (16,000 gallons of water per cycle) has been installed. The defloridation material used is slightly different from Defloron-2 developed earlier by the

Institute. A novel method of regeneration of the medium, known as alum-pot instead of gravity-type is being tried in this plant. It has been observed that this new technique of regeneration by alum-pot is easy to operate.

3. Phenol values of various activated carbons

Several samples of activated carbon received from various manufacturers all over India have been tested for their phenol values. Thirty per cent of the samples gave phenol values in the range of the 10 to 20, fifty per cent in the range of 25 and the rest above 100.

4. Air Pollution Survey

Five sampling stations have been set up at various places, mostly industrial and thickly populated areas. Regular samples are being collected and analysed for the usual parameters as a part of the National Air Sampling Programme.

5. Characterisation of Refuse

About 150 samples of refuse have been collected from various sampling points and analysed as a part of the National Programme of Refuse Collection and Disposal.

JAIPUR

1. Chambal River Survey at Kota

Work on this project has been completed and a report submitted.

2. Air Pollution Survey

The air pollution studies in the industrial complex of Kota having sulphuric acid plant, a rayon factory, a fertiliser factory and a PVC plant, are being continued as a part of the National Air Sampling Programme.

3. Characterisation of Refuse

Sampling and analysis of refuse samples from a number of localities, representing residential, industrial and market places is being continued as a part of the National Programme of Refuse Collection and Disposal.

KANPUR

1. Treatment of Industrial Wastes

Laboratory and pilot plant scale work on the following industrial wastes was carried out.

(a) Chrome Tanning wastes : This work has since been completed and a report submitted.

(b) Wastes of high organic contents including those from vegetable tanning wastes : Laboratory model studies have been set up and observations on the treatability of these wastes are being made.

2. Bioassay Studies of Industrial Wastes and Insecticides

Further work was carried out on this problem with more commercial insecticides with different species of locally available fish during the monsoon period (fish are available only during monsoon). Median Tolerance limits of the species tried were evaluated and calculated.

3. Survey of River Gomati in Lucknow Region to assess its Pollutional Status

A short term survey (4 months) of River Gomati in Lucknow region was conducted during the summer period. The objective of survey was to assess the pollutional load contributed by the outfalls from Lucknow Town to the River. Quality of the river water was also assessed at a distance of about 60 km. downstream of Lucknow to study the recovery of the River.

Outfalls releasing the wastes into the river were also surveyed. Information on the volumes of water coming out of each outfall was also collected. A report on the work done is being prepared.

4. Air Pollution Survey

Fortnightly samples for gaseous analysis, suspended particulate matter and dustfall rate are being conducted monthly as a part of the National Air Sampling Network.

5. Characterisation of City Refuse

Samples from different types of areas have been collected once a week and analysed as a part of the National Programme of Refuse Collection and Disposal.

MADRAS

1. Characterisation and Treatment of Industrial Wastes

Laboratory and pilot plant scale work involving physico-chemical and biological principles is in progress on the following industrial wastes : (a) Wastes from M/s Seshasayee Paper and Paper Boards, Erode: (b) Wastes from Trichy Distilleries and Chemicals, Trichy; (c) Tannery wastes, Madras; (d) Salughter House Wastes, Madras; and (e) Sago Mill Wastes, Salem.

2. Sewage Treatment

a) Performance of Oxidation Ponds

Performance of 3 oxidation ponds functioning in the College of Engineering, Guindy, the Indian Institute of Technology and the Central Polytechnic Madras: is being studied by collecting samples once in a fortnight from each of the ponds. Samples are analysed for physical, chemical, biological and bacteriological characteristics and are being evaluated.

b) **Characteristics of Sewage in Madras City**

Samples of sewage from the important pumping stations were collected and analysed. System rate constant and BOD, K value of the samples were also determined.

3. Air Pollution Survey

Six more sampling stations for the city short term survey were selected. Systematic fortnightly samples from these stations are being carried out and these are being analysed as a part of the National Programme of Air Sampling.

Two sampling stations for the city long-term air pollution survey *viz*, General Hospital and Ennore were also selected and work on the sampling and analysis is being continued.

4. Characterisation of Refuse

Ten sampling sites were selected representing : (a) General market, (b) Industrial, (c) Residential, (d) Commercial and (e) Suburban areas. Samples are being analysed for physical as well as chemical characteristics as a part of National Programme of Refuse Collection and Disposal.

SYMPOSIA & SEMINARS

Research & Development Conference on Public Health Engineering

The CPHERI, Nagpur organised a Conference on Public Health Engineereng Research & Development at Nagpur for 3 days from 28th to 30th January, 1971. The Conference was inaugurated by Dr. Atma Ram, the then Director-General, Scientific & Industrial Research, who stressed both for national and international efforts to help ensure supply of safe water to every human being.

About 140 eminent Engineers, Scientists, Professors, Administrators and Economists attended this Conference which was the first of its kind to be organised in the country, to help draw up a realistic research programme in the following fields : (i) Water Treatment, (ii) Waste Water Treatment and Disposal & (iii) Distribution, Drainage and Rural Sanitation.

The deliberations of the Conference, which was a direct outcome of an earlier International Conference organised by the World Health Organisation at Dubrovnik, Yugoslavia, provided a useful forum and encouraging suggestions have come forth from the delegates who had come to attend this conference.

The recommendations made at the Conference have been published in the form of a booklet: "Research & Development Needs in Public Health Engineering in India."

Seminars

Weekly seminars by staff members of the Institute as well as the distinguished visitors continued to be a regular feature. These seminars enable to assimilate research trends in the Public Health Engineering field. During the year, about 40 seminars were arranged.

The Institute actively participated, in the symposia, conferences and seminars organised by other organisations such as Indian Institute of Science, Bangalore; Indian Institute of Che-

mical Engineers, New Delhi; Indian Water Works Association, Bombay; Indian Pulp & Paper Technical Association, New Delhi, The Institution of Engineers (India), Baroda, Society for Clean Environment (SOCLEEN), Bombay and Indian National Science Academy, New Delhi. The Institute also collaborated with the M. S. University, Baroda in organising a 1-day seminar on Dairy waste. The Institute also participated in the special session of the pulp and paper mill waste at the Annual meeting of the Indian Pulp & Paper Technical Association held at New Delhi.

TRAINING, INFORMATION, LIBRARY & EXTENSION SERVICES

TRAINING

The Institute had organised following 8 courses during the year :

	Course	In Collaboration with	Month/duration	No of participants
1.	Corrosion Control in Water & Waste Water Engg.	Corrosion Advisory Bureau, Jamshedpur	Feb. 71 (4 days)	80
2.	Water & Waste Water Analysis	—	i) Feb.-Mar. 71 (2 months)	18
			ii) Aug.-Oct. 71 (2 Months)	13
3.	Plastics Plumbing	Bombay Municipal Corporation	March 71 (2 days)	12
4.	Sewage Treatment Plant Operator's course	-do-	Mar-Apr. 71 (2 days)	15
5.	Process Desing in Waste Treatment	Govt. Polytechnic, Nagpur	May-June, 71 (1 month)	22
6.	Sewage Farming	—	Nov. 71 (3 days)	25
7.	City Refuse Disposal	—	Nov. 71 (3 days)	27
8,	Structural Engg. for P. H. Engineers	SERC, Madras	Dec. 71 (10 days)	6

These training facilities have also been availed of by participants from some of the neighbouring countries

Students from other Countries

Name & Address	Duration	Subject of Study
1. Mr. Lauro G. Salonga Water Analyst National Water Works & Sewerage Authority, Manila, Phlllipines	2 weeks	Water & Waste Water Analysis
2. Mr. Charles Lwanga, Inchrge, Water Examination Division Govt. Chemists Analytical Laboratory, Kam pala, Uganda (on WHO Fellowship)	2 weeks	Water Treatment Studies & Water Quality Control
3. Mr. Taha Al Atrash Ministry of Muni cipal & Rural Affairs Damascus, Syria (on WHO Fellowship)	1 week	Waste Disposai
4. Mr. Moon Shik Zong, Assistant Professor, School of Public Health Seoul (South Korea) (on WHO Fellowship)	1 week	Environmental Health
5. Mr. N. V. Ramamohanrao, Senior Water Analyst & Head of the Department of Water & Waste Water examination, Institute of Preventive Medicine, Hyderabad.	1 month	Public Health Engineering
6. Prof. A. D. Patwardhan Astt. Professor (PHE) Victoria Jubilee Technical Institute, Matunga, Bombay.	3 years	For Ph. D. Work under 3 year Doctoral Programme of the Quality Improvement Programme sponsored by the Ministry of Education New Delhi.

The Institute continued to collaborate with the Visvesvaraya Regional College of Engineering in their postgraduate teaching programme for M. Tech. (PHE) degree. Training/ Research facilities in various aspects of public health engineering and allied subjects were also provided to individuals and research/educational institutions.

Training was also imparted to the Sanitary Inspectors deputed by the Public Health Institute, Govt. of Maharashtra, Nagpur.

Publications

Indian Journal of Environmental Health

In view of existence of some other journals having similar title as that of the Institute's journal, the title has been changed to "Indian Journal of Environmental Health." The journal is circulated to all members of the Indian Association for Water Pollution Control. A copy of the jouarnal is included in the subscription of the members of the Association. This arrangement has resulted in a substantial increase in subscribers which now stands at 800 as against mere 400 last year. The journal, which is in the 13th year of publication is sent on exchange basis to about 80 educational/research institutes/ organisations not only in India but also in many foreign countries.

Technical Digest

The Institute continues to publish a one-page "Technical Digest" every month covering some aspect of public health engineering work in the country.

The following topics were highlighted in the series of these leaflets during the year :

January 1971	Survey of Water Treatment Plants
February 1971	Membrane Filter
March 1971	Refuse Disposal Studies at Calcutta
April 1971	Water Pollution in Durgapur – Asansol Region
May 1971	Health Status of Sewage Farm Workers
June 1971	Bituminous Coal – A substitute Filter Media for Anthracite
July 1971	Enumeration of Viruses in Waste Waters
August 1971	Reuse of water
September 1971	Dairy Wastes : Treatment & Disposal
October 1971	Textile Workers & Byssinosis
November 1971	Micrometeorological Instruments for Air Pollution Studies
December 1971	Refuse Disposal from Multistoreyed Buildings.

The Technical Digest has been serving as a very effective media for disseminating the research work of the Institute. Work put up by other public health engineering organisations will be covered in the issues to come. The digests were distributed to over 3,000 people both in the country and other foreign countries. These have been well received by the readers as also by the newspapers in India, who in turn, gave special write-ups to items like sewage farming, air pollution control studies and health status of sewage farm workers.

SPECIAL PUBLICATIONS

The following special publications were brought out during the year :

1. Booklet "Research & Development Needs in Public Health Engineering in India"
2. "Dairy Wastes : Treatment & Disposal"
3. Booklet : "Training Programmes"
4. Annual Report - 1970
5. Booklet : Testing & Analyses Advisory Services
6. Vigyan Pragati (Special No. on Health Hazards)

It is worth mentioning that "SPAN" the leading popular journal brought out by the United States Information Service, having a circulation of about 300,000 per month, had highlighted with illustrations, the activities of the Institute in January 1971 issue Similarly, a special article on the Institute was published in "World Health Bulletin" (August-September, 1971 issue) which has also a similar wide circulation.

Research & Development Conference

The Unit assisted in organising the Conference which was attended by nearly 140 delegates from all over the country. A booklet entitled "Research and Development Needs in Public Health Engineering in India," has also been brought out.

Seminar on Dairy Wastes at Baroda

The Institute organized a one-day seminar on "Treatment and Disposal of Dairy Wastes" on 19th April, 1971 at Baroda in collaboration with the M. S. University, Baroda.

Various topics such as characteristics, treatment and disposal of dairy wastes and by-products recovery were discussed at the seminar which was attended by about 70 participants comprising reserch workers, dairy management officers, scientists, public health engineers and postgraduate students. Papers presented at the Seminar have been compiled in the form of a booklet for distribution.

Seminar on Pulp and Paper Mill Wastes at Delhi.

The Institute also participated in the Special session on various aspects of pulp and paper mill waste at the annual meeting of the Indian Pulp & Paper Technical Association held at New Delhi and presented papers. One of the Institute's papers was adjudged as the best and was awarded a gold medal.

Library

The Institute's library has moved to its new building. This has facilitated in increasing its activities besides providing proper reading environment as well as adequate space for storage, display etc. This has helped in creating congenial atmosphere for reading. Special efforts were made to obtain Indian as well as foreign standards, research reports, proceedings of conferences/ symposia, etc. pertaining to the field of public health engineering and allied sciences. A considerable number of trade literature pertaining to public health engineering products has also been procured. A new publication entitled "Guide to Current Public Health Engineering Literature" is being brought out with a view to create current awareness of nascent information which is of interest in the field of public health engineering. This publication has been very well received by research workers.

The Library is also making special efforts to procure copies / synopsis of the Masters as well as Doctoral theses, dissertations accepted by the various Universities, Institutes. This would enable the researchers to know about advances and contributions made by others which hitherto used to remain in dormant state because of the non-availability of such literature which is rarely published.

A special book exhibition entitled "Environment–Quality of Life" was arranged in cooperation with the United States Information Service, Bombay.

CONSULTATION CELL

The Institute continued to render assistance to Government Departments, Municipalities, Corporations, Industries, Local Bodies etc., on the basis of "know-how" developed, to solve their problems in water and wastewater treatment, air pollution surveys and solid wastes disposal. This assistance has been given on consultation basis.

The consultation works attended to during the year are given below.

(A) Sponsored Research/Investigation

Sl. No.	Name of sponsoring Authority	Nature of problem
1)	Orient Paper Mills, Amlai	Treatment of Pulp and Paper Mill Wastes
2)	Gwalior Rayon Silk Mfg. Co. Mavoor	Treatment of Rayon Pulp Mill Wastes
3)	City & Industrial Development Corporation, Bombay	Air Pollution Survey of North Bombay
4)	Bombay Municipal Corporation	Air Pollution Survey of Greater Bombay
5)	Govt. of Tanzania	Defloridation of water from ARUSHA region
6)	Calcutta Metropolition Development Authority	Characterisation of refuse from Howrah city.

(B) Consultation Work :

Sl. No.	Name of Client	Nature of Problem
1.	Indian Telephone Industries, Doorvani Nagar, Bangalore.	Provision of Oxidation Ditches for Sewage Treatment
2.	Seshasayee Paper & Board Mills, Erode (Tamil Nadu)	Effluent Treatment & Disposal
3.	The West Coast Paper Mills, Dandeli (Mysore State)	Effluent Disposal
4.	Zenith Steel Pipes Ltd., Khopoli, Bombay	Effluent Treatment
5.	The Anil Starch Products Ltd., Ahmedabad	Treatment & Disposal of Starch Factory Waste
6.	The Bharat Vijay Mills Ltd. Kalol (N. Gujarat)	Effluent Treatment

Sl. No.	Name of Client	Nature of Problem
7.	City & Industrial Development Corporation of Mahrashtra, Bombay.	Sewage Treatment
8.	Bharat Electoronics Ltd., Jalahalli, Bangalore	Sewage Treatment
9.	Bakelite Hylam Ltd., Hyderabad	Effluent Treatment
10.	Harihar Polyfibers, Harihar, Mysore State	Treatment of wastes from Polyfibers Factory
11.	Coca Cola Export Corporation, New Delhi.	Treatment of water for bottling Plants at Madurai and Indore
12.	Hindustan Polymers Ltd., Vishakhapatnam	Treatment of Distillery effluent
13.	The Central Pulp Mills Ltd , Fort, Songadh (G. S.)	Effluent Treatment and Disposal.
14.	Brooke Bond India Ltd., P. O. Tundla (Agra) U. P.	Sewage Treatment
15.	Superintending Engineer, Bank Note Press Construction Circle, Indore	Treatment of wastes from Bank Note Printing Press
16.	Manager, Cordite Factory, Nilgiri.	Effluent Treatment and Disposal
17.	Straw Products Ltd., Jaykaypur Rayagada, Orissa	Effluent Treatment and Disposal
18.	Executive Engineer, P & T Division, Jabalpur	Design of Oxidation ponds
19.	Hindustan Organic Chemicals, Rasayani.	Treatment of organic chemical waste
20.	Gujarat State Fertilizer Co., Baroda	Treatment of Fertilizer waste
21.	Fertilizer Corporation of India, Gorakhpur	—do—
22.	Fertilizer Corporation of India, Barauni	—do—
23.	Calico Mills, Ahmedabad	Treatment of textile wastes
24.	Tribeni Tissues Pvt. Ltd., Calcutta	River Survey
25.	Andhra Sugars & Fertilizers, Kovvur (AP)	Treatment of Factory wastes
26.	Cellulose products of India. Kathwara (G. S.)	Characterisation and treatment of Maize Products & Straw board wastes

Sl. No.	Name of Client	Nature of Problem
27.	Warner Hindustan, Uppal, Hyderabad	Chemical factory waste disposal
28.	Mohan Meakin Breweries Ltd., Ghaziabad	Effluent Treatment
29.	Hindustan Levers Ltd., Research Centre, Chakla	Treatment of effluent waters
30.	Sri Ram Chemical Industries, Sri Ram Nagar, Kota	Disposal of waste waters
31.	Bhabha Atomic Research Centre, Heavy Water Project Division, Bombay.	Oxidation Ponds for Housing Colony of Heavy Water Project at Rawat-Bhata
32.	National News Print & Paper Mills, Nepa Nagar	Effluent Disposal from Paper Mills
33.	Kaira Dist. Co-operative Milk Producers Union, Anand	Effluent Treatment for Dairy Waste at Anand
34.	Associated Pulp and Paper Mills, Bavla (Ahmedabad)	Effluent Disposal
35.	The Anakapalle Co-operative Agricultural & Industrial Society Ltd., Anakaaplle (R. S.) Vishakhapatnam, Dist. (A. P.)	Distillery effluent treatment and Disposal
36.	Navsari Oil Mills, Navasari	Effluent Disposal
37.	Municipal Corporation of Greater Bombay, Bombay	Improvements to water works and sewarage system of Greater Bombay
38.	Indian Petrochemicals Corporation of India, Baroda	Treatment of Petrochemicals Plant effluent
39.	Kalol Nagarpalika, Kalol (N. Gujarat)	Effluent disposal survey at Kalol
40.	Bhabha Atomic Research Centre, Trombay, Bombay	Sewage Treatment for the housing colony at Tarapur
41.	Sri Ambika Mills Ltd., Ahmedabad	Effluent Characterisation
42.	Government of Maharashtra	Umrer Water Supply Scheme
43.	Central Training Institute Hyderabad	Defloridation of Water

Besides these, the Institute supplied technical notes and answers to queries from about 80 organisations and public bodies.

COORDINATION CELL

The Cell assists the Director, CPHERI in expeditious implementation of research schemes, by way coordinating the research activties at the Headquarters and its network of eight Zonal Laboratories. The cell undertakes periodically the appraisal of various research schemes especially at the Zonal Labortories.

WORKSHOP

The Institute has a well-equipped workshop. It undertakes fabrication of equipment/ apparatus, including pilot plants as may be required for research projects from time to time. Special mention may be made of the Pilot Plant Units like Biological Disc for sewage treatment, Lysimeter for refuse leachate studies and Blanket type sludge clarifier for waste water treatment. Other equipement/apparatus fabricated during the year include : package type water treatment plant, coagulant aid dispenser, Kit boxes for water sampling for field work, Wind direction/ velocity recording instruments, perspex made laboratory models, Air sampling equipment. etc.

GLASS BLOWING SECTION

The section underakes fabrication of specialised types of glasswares as required for research programme of the Institute. This facility has obviated the loss of time in procurement of these glasswares and thus made, in its own way, contribution to speedy execution of research programmes.

The glasswares are also supplied, upon request, to various research/educational institutions and other interested agencies, against payment.

As a result of wide circulation of the booklet "CPHERI Glasswares" earlier in 1970, a lot of requests have been pouring in for procurement of the glasswares. These have been attended to from time to time.

A list of few items of glassware supplied to outside institutes, such as Maharashtra Engineering Research Institute, Nasik; Directorate of Fisheries, (Maharashtra); Maharashtra State Water Pollution Investigation Centre and Laboratory, Bombay; National Institute of

Occupational Health, Ahmedabad; Bhabha Atomic Research Centre, Bombay and several others, is given below :

	Item	Quantity
1)	Microelectrophoresis Cell (Riddicks)	1
2)	Fume Exhaust (Manifold Units)	19
3)	Microkjeldahl distillation unit	15
4)	Sedgwick rafter cell	32
5)	Sedgwick rafter funnel	19
6)	Sintered glass diffuser (Cyl.)	227
7)	Air Sampling bubbler	159
8)	Microcondenser	1

PHOTOGRAPHY SECTION

The Institute's Photography Section which is well equipped, prepares microfilms, photocopies, slides, photomicrographic and other photographic work required for ressearch activities of the Institute.

SPECIAL REPORTS

On sponsored research schemes, the Institute in general, submits a special report to the sponsors. These special reports cover assessment of the problem, investigation - Laboratory and pilot scale as the case may be, emerging conclusions and the recommendations.

The special reports brought out during the year are listed below :

	Report	Sponsor (s)
1)	Proposal for setting up a Defloridation Plant in Tanzania.	Government of Tanzania.
2)	Quality of River Water in Kerala and General Recommendations of Treatment.	Chief Engineer (PH) Government of Kerala
3)	Kumili Water Supply Scheme, Kerala.	-do-
4)	Treatment of Newsprint Factory Wastes at Nepanagar.	National Newsprint & Paper Mills, Nepanagar.
5)	Umrer Water Supply scheme	Public Health Department Maharashtra State.
6)	Sewage Treatment for FRP Housing Colony, Tarapur.	Bhabha Atomic Research Centre, Bombay.
7)	Report on Synthetics & Chemicals Wastes.	Project Manager, Synthetics & Chemicals, Bombay.
8)	Disposal of Distillery Effluents from the factory	Hindustan Polymers, Vishkhapatnam.
9)	Oxidation Ponds for Housing colony at Rawat Bhata	Bhabha Atomic Research Centre, Heavy Water Project, Bombay.
10)	Effluent characterisation and laboratory studies on treatability of wastes.	Cellulose Products of India. Ltd; Kathwara.
11)	Treatment & Disposal of Sanitary sewage & industrial wastes at Kalol.	Kalol Municipality, Kalol.
12)	Distillery Effluent : Treatment and Disposal	The Anakpalle Co-operative Agricultural and Industrial Society, Thummapala. Anakapalle.
13)	Feasibility Report on the Effluent Treatment	Gujarat State Fertilizer Co. Baroda

Report		Sponsor (s)
14)	Disposal of Factory wastes	General Manager, Neoli Sugar Factory
15)	Treatment & disposal of sugar factory wastes	Andhra Sugars & Fertilizers, Kovvur
16)	Treatment of Aromatics Project Wastes	Indian Petro-chemicals Complex Ltd; Jawaharnagar, Baroda
17)	Effluent treatment & disposal	General Manager, Calico Mills. Ahmedabad
18)	First Year Report on CPHERI as a Regional Reference Centre on Air Pollution	World Health Organization, Geneva, Switzerland
19)	Investigations on Air Quality at Hindustan Aeronautics Ltd., Hyderabad	Hindustan Aeronautics Limited, Hyderabad
20)	Proposal for Air Pollution Programme at Calcutta	Calcutta Metroplitan Development Authority (CMDA)
21)	Proposal for Comprehensive study of Atmospheric conditions affecting air pollution in new Bombay & surrounding region (A long term project)	City and Industrial Development Corporation of Maharashtra Ltd., (CIDCO)
22)	A Short Term air Pollution Study for twin city Region (Interim Report)	—do—
23)	A short term Air Pollution Study for Twin City Region (Final Report)	—do—
24)	Air Pollution Survey at A. C. C. Bulk Cement Distribution Depot, Okhla, New Delhi	Associated Cement Co. Ltd., Bombay
25)	Atmospheric Pollution Causing corrosion of the OHE and Transmission line fitting between Kalyan and Titwala region.	Central Railway
26)	Atmospheric Pollution due to Fertilizer Industries at Madras	Respective Fertilizer Industries : a) EID Parry & Co. Madras b) Kothari & Sons, Madras c) Shaw Wallace & Co. Madras

Report	Sponsor
27) Investigations on possible Atmospheric Pollution due to Cement Manufacturing Plants (Preliminary Survey)	Bagalkot Udyog Ltd., Bijapur Distt; Mysore State
28) Investigations on Atmospheric Pollution causing damage to vegetation	Navin Fluorine Industries, Udhna, Surat, Gujarat
General	
29) Environmental Problems in India by Prof. S. J. Arceivala, Ex-Director, CPHERI	
30) Detection of Viruses in Water by Dr. V. Chalapati Rao, Scientist, CPHERI	

PUBLICATIONS

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   The Changing Pattern of Industrial Water Utilisation,
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2. Arora H. C., Shrivastava S. K. and Seth A. K.
   Bioassay Studies of Some Commercial Organic Insecticides-Part I
   Environmental Health, 13, 3, 226-223 (1971).

3. Arora H. C., Sharma V. P. & Chattopadhya S. N.
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4. Bhide A. D. & Godbole P. N.
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5. Bhide A. D., Titus S. K., Alone B. Z. & Dave J. M.
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   Pressure Filtration Studies with Indigenously Developed Filter Aids Usins Stella Filter,
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9. Dave J. M., Shah S. J. & Bhavnani H. V.
   Performance of Some Filter-aid Materials using a Stellar Water Filter,
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10. Deshpande S. V. & Kshirsagar S. R.
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    Environmental Health, 13, 4, 297-299 (1971)

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12. Dixit R. C. & Pathak B. N.
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13. Dixit R. C. & Pathak B. N.
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14. Khare G. K. & Sastry C. A.
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15. Kshirsagar S. R.
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Jnl. Instt. of Engineers (India) 51, 6 Pt PH 2, 42-44 (1971).

17. Kshirsagar S. R. & Kulkarni A. L.
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18. Kshirsagar S. R.
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19. Kshirsagar S. R.
Fluordation and Defloridation of Water Supplies,
Jnl. IWWA, III, 2, 116 – 123, (1971).

20. Krishnamurthi K. P. & Rajagopalan S.
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Proc. Symp. on "Mollusca" Part III, 746 – 754 (1971).

21. Kulkarni H. R., Khan S. U. & Deshpande W. M.
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23. Mohanrao G. J. & Subrahmanyam P. V. R.
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29. Siddiqi R. H. Ratnaparkhi D. Y. & Agarwal S. C.
Nitrification in Tracatment of Nitrogeneous Fertilizer Industry Waste Water,
Environmental Health, 13, 2, 128-138 (1971).

30. Siddiqi R. H. & Handa B. K.
Evaluation of Some Stabilisation Pond in India,
Jnl. Sani. Engg. Divn. Proc. of ASCE, 91-100, (Feb, 1971).

31. Seth G. K.
Some Aspects of Research by CPHERI in the Fields of Water Supply & Sewage Disposal,
Civic Affairs, 19, 1, 45-54 (1971).

32. Shende G. B.
Sewage Farming,
UNI Agri. Service, 1 (10) 269-273.

33. Thergaonkar V. P. & Kulkarni D. N.
Observations on the Relationship between Alkalinity and Fluorosis in Fluoride Bearing Areaes, Environmental Health, 13, 2, 144-152 (1971).

34. Tuli J. M., Seth A. K. & Shrivastava S. K.
IIP, Dehradun has Red Water Problem,
Jnl. IWWA III, 1, 64-69 (1971).

PATENTS

The Institute has filed the following 17 patents so far :

Patents sealed :

108437	A process for the manufacture of medium for removal of fluoride from drinking water
115574	Coagulant aid CA-3
116648	Chlorine tablets
116953	Coagulant aid CA-4
116996	Coagulant aid CA-5
116997	Iodine tablets
117025	Coagulant aid CA-7

Patents accepted :

107912	Refrigerated vessels for maintaining biological tissues and cultures for minimum of 24 hrs. & maximum upto 48 hrs. for continental and intercontinental despatches
118995	Defluoron-2
122997	An apparatus for recording wind direction

Patents Filed :

123577	Synthetic polyanionic coagulant aid CA-11
129070	Coagulant aid CA-15
129055	Membrane Filter

Patents Applied :

123209	Filter aid FA-1
123644	Filter aid FA-2
129109	An apparatus for recording wind velocity
130443	A domestic iron removal unit (DIRU)

BUDGET

(Rs. in Lakhs)

	1970-71 (Actual Expenditure)	1971-72 (Revised Budget)
RECURRING	35.636	37.420
CAPITAL	7.756	3.920
PILOT PLANTS	3.713	3.770
TOTAL	47.105	45.110

PILOT PLANTS

The following pilot plants were in operation during the year :

Machanical Composting plant	(Nagpur)
Aerated Lagoons with fixed & floating aerators	(Nagpur)
Oxidation ditch	(Nagpur)
Effluent farm irrigation	(Nagpur)
Stabilisation ponds (under construction)	(Nagpur)
Trickling Filter (under construction)	(Nagpur)
Biological disc (under construction)	(Nagpur)
Water Filtration Plants	(Bombay)

MEMBERSHIP IN ORGANISATIONS

Sl. No.	Name of the Committee	Ministry/Govt. Deptt/Organisation constituting the Committee.	Name of CPHERI representative Principal Member (P) Alternate Member (A)
(1)	(2)	(3)	(4)
	(A) INTERNATIONAL COMMITTEES		
1.	International Association on Water Pollution Research, Pretoria, South Africa.	As under (2)	1) Dr. G. J. Mohanrao, (P) 2) Dr. G. K. Seth, (P)
2.	International Water Supply Association, London.	-do-	Shri V. Raman (P)
3.	Treatment Plant Committee for Tertiary Treatment.	Water Pollution Control Federation, U. S. A.	Dr. G. J. Mohanarao, (P)
4.	Technical Association of the Pulp & Paper Industry, Technical Committee.	Pulp & Paper Industry Technical Association, Atlanta, Georgia, (USA)	Dr. G. K. Seth, (Affiliate Member)

(1)	(2)	(3)	(4)

B) NATIONAL COMMITTEES
(I) INDIAN STANDARDS INSTITUTION, NEW DELHI

1.	Sanitary Appliances & Water Fittings Sectional Committee	BDC : 3	Indian Standards Institution, New Delhi.	Shri B. B. Bhalerao (P) Shri S. R. Alagarsamy (A)
2.	Domestic & Municipal Water Fittings Sub-Committee.	BDC : 3 : 2	–do–	Shri S. R. Kshirsagar (P) Shri V. Raman (A)
3.	Water Meters Sub-Committee	BDC 3 : 4	–do–	Shri N. M. Narsimhan (P) Shri A. W. Deshpande (A)
4.	Water Works Fitting Sub-Committee	BDC 3 : 5	–do–	Shri A. K. Seth (P) Shri V. Hanumanulu (A)
5.	Plastic Pipes Sub-Committee	BDC 3 : 8	–do–	Shri V. Raman (P) Shri A. K. Seth (A)

(1)	(2)	(3)	(4)
6.	Fluid Flow Measurements in Closed Conduits Sectional Committee	BDC 17 : 3	Indian Standards Institution, New Delhi.	Shri R. Paramasivam (P) Shri A. W. Deshpande (A)
7.	Dilution Methods Sub-Committee	BDC 17 : 7	-do-	Shri D. Raguraman (P) Shri A. K. Seth (A)
8.	Water Supply & Sanitatation Sectional Committee	BDC 24	-do-	Shri V. Raman (P) Shri V. Hanumanulu (A)
9.	Drainage Sub-Committee	BDC 24 : 2	-do-	Shri R. Paramasivam (P) Shri A. K. Seth (A)
10.	Sanitary Installations Sub-Committee	BDC 24 : 3	-do-	Shri V. Raman (P) Shri N. M. Narasimhan (A)
11.	Soil and Waste Pipes above Ground Sub-Committee	BDC 24 : 4	-do-	Shri V. Raman (P) Shri N. M. Narasimhan (A)

(1)	(2)	(3)		(4)
12.	Rubber Joint Rings Panel	BDC 24/P1	Indian Standards Institution, New Delhi.	Shri B. B. Bhalerao (P) Sri A. W. Deshpande (A)
13.	Waste Stabilization Ponds Panel	BDC 24/P3	-do-	Shri S. R. Alagarsamy (P) Shri Y. S. Murty (A)
14.	Panel for Draft Code of Practice for Water Supply and Drainage System at High Altitude	BDC 24/P4	-do-	Shri S. R. Kshirsagar (P) Shri R. Paramasivam (A)
15.	Building Materials and Components Sampling Sub Committee	BDC 31	-do-	Shri B. B. Bhalerao (P) Shri S. R. Alagarsamy (A)
16.	Public Health Engineering Plants and Equipment Sectional Committee	BDC 40	-do-	Dr. R. H. Siddiqi (P) Shri B. B. Bhalerao (A)

(1)	(2)	(3)		(4)
17.	Water Treatment Equipment Panel	BDC 40/P1	Indian Standards Institution, New Delhi.	Shri S. K. Gadkari (P) Shri S. R. Kshirsagar (A)
18.	Sewage Treatment Equipment Panel	BDC 40/P2	-do-	Dr. R. H. Siddiqi (P) Shri B. B. Bhalerao (A)
19.	National Building Code-Panel for Plumbing Services	BDC 64/P16	-do-	Shri D. Raghuraman (P) Shri N. M. Narasimhan (A)
20.	Civil Engineering Division Council	CEDC	-do-	Dr. R. H. Siddiqi (P) Shri V. Hanumanulu (A)
21.	Chemical Hazards Sectional Sub-Committee	CDC 18	-do-	Shri K. R. Bulusu (P) Shri B. N. Pathak (A)
22.	Industrial Chemical Hazards Sub-Committee	CDC 18 : 4	-do-	Shri B. N. Pathak (P) Shri V. P. Thergaonkar (A)

(1)	(2)	(3)		(4)
23.	Air Pollution Sub-Committee	CDC : 18 :5	Indian Standards Institution New Delhi.	Shri P. K. Yennawar (P) Shri H. B. Singh (A)
24.	Disinfectants Sub-Committee	CDC 23 : 1	–do–	Dr. N. U. Rao (P) Dr. N. M. Parhad (A)
25.	Water Sectional Committee	CDC 26	–do–	Dr. G. J. Mohanrao (P) Dr. G. K. Seth (A)
26.	River Water & Industrial effluents Sub-Committee.	CDC 26 : 1	–do–	Dr. G. J. Mohanrao (P) Dr. P. V. R. Subrahmanyam (A)
27.	Panel for Food & Fermentation Industry Wastes.	CDC 26 : 1 : 2	–do–	Dr. G. J. Mohanrao (P) Shri V. Hanamanulu (A)
28.	Paper & Allied Industrial Water Analysis.	CDC 26 : 1 : 3	–do–	Dr. P. V. R. Subrahmanyam, (Convener)

(1)	2)	(3)		(4)
29.	Panel for Tanning Industry Wastes.	CDC 26 : 1 : 4	Indian Standards Institution, New Delhi.	Dr. C. A. Sastry, (Convener)
30.	Panel for Textile and Allied Industry Wastes.	CDC 26 : 1 : 5	-do-	Shri S. Rajagopalan, (Convener)
31.	Panel for Chemical and Allied Industry Wastes.	CDC 26 : 1 : 6	-do-	Dr. G. J. Mohanrao (Convener) Dr. C. A. Sastry (A)
32.	Panel for Fertilizer Industry Wastes	CDC : 26 : 1 : 12	-do-	Shri S. R. Algarsamy (P)
33.	Panel for Steel Mill Wastes	CDC 26 : 1 : 13	-do-	Dr. G. J. Mohanrao (P) Shri V. Hanumanulu (A)
34.	Methods of Test for Water and Effluents	CDC 26 : P1	-do-	
	(a) Physical and Chemical Test Methods			Shri R. C. Trivedi (P) Dr. K. L. Saxena (A)
	(b) Bacteriological and Virological Methods			Dr. N. M. Parhad (P) Shri M. D. Patil (A)

(1)	(2)	(3)	(4)
35. Panel for Microbiological Methods test for water	CDC 26 : P2	Indian Standards Institution, New Delhi	Dr. N. U. Rao (P) Dr. H C. Arora (A)
36. Panel for treatment of water for industry.	CDC 26 : P7	–do–	Shri K. R. Bulusu, (P) Shri B. N. Pathak, (A)
37. Water for Industrial Purposes Sub–Committee	CDC 26 : 2	–do–	Shri K. R. Bulusu (P) Shri B. N. Pathak (A)
38. Water and Effluents Sub–Committee	CDC 26 : 3	–do–	Dr. N. U. Rao (P) Dr. V. Chalapati Rao (A)
39. Panel for Marine Disposal of Effluents	CDC 26 : 3 : 1	–do–	Dr. G. J. Mohanrao (P) Dr. A. K. Basu (A)

(1)	(2)	(3)	(4)
		(II) OTHER COMMITTEES	
1.	Expert Committee set-up by the Ministry of Health, Government of India to prepare a Manual on :	Ministry of Health, Government of India	
	(a) Water Supply and Water Treatment		Shri V. Raman (P) Shri S. R. Kshirsagar (A)
	(b) Sewerage and Sewage Treatment		Dr. R. H. Siddiqi (P) Shri R. Paramasivam (A)
2.	Ad-hoc Committee set-up by the Ministry of Health, Government of India to prepare draft Air Pollution Control Bill.	Ministry of Health, Government of India	Shri P. K. Yennawar (P)
3.	Water Resources Committee of the South-East Resource Region.	Government of India.	Dr. G. J. Mohanrao (P) Shri V. Hanumanulu (A)

(1)	(2)	(3)	(4)
4.	Problems of Sanitary & Water Supply Arrangements at High Altidues and Low Temperature Regions.	Ministry of Defence Govt. of India.	Shri D. Raguraman (P)
5.	Water Pollution Prevention Board of the Government of Maharashtra.	Government of Maharshtra.	Dr. G. J. Mohanrao (P) Shri V. Raman (A)
6.	Working Group on Air and Water Pollution	Government of Gujarat.	Dr. G. J. Mohanrao (P) Shri S. Rajagopalan (A)
7.	Rural Sanitation Advisory Committee	Kasturba Health, Society, Sewagram (India)	Dr. A. K. Anwikar (P)

DEPUTATIONS, HONOURS & AWARDS

1. Prof. S. J. Arceivala, Ex-Director was deputed to Dubendorf/Zurich to act as an Expert Member to the WHO in the Expert Committee Meeting on Solid Wastes Disposal and Control during June 1971.

2. Shri K. R. Bulusu, Scientist was deputed to Tanzania, as per the request of the Ministry of External Affairs, Govt. of India, for a period of 2 weeks during May-June 1971 for preparing a reports for setting up Defl oridation Plant in Tanzania. Shri Bulusu was again invited for a period of 12 weeks from 23. 10. 1971 for construction & operation of the plant.

3. Dr. N. U. Rao, Scientist was deputed to Hungary and Yugoslavia to attend the Second International Congress for Virology and to attend the Fourth International Conference on Science & Society for a period of about two weeks during June-July 1971.

4. Dr. R. H. Siddiqi, Scientist, was deputed to Bangkok, Thailand to attend the United Nations Conference on Human Environment during August 1971 at the invitation of the ECAFE, Bangkok.

5. Dr. R. H. Siddiqi, Scientist was deputed to Geneva to attend the meeting of the International Hydrological Decade Working Group on Quality of Water during Sept. 1971. The working group drafted an outline of a Guide Book on measurements and data needed in water quality surveys.

6. Shri Y. S. Murty, Scientist, proceeded to USA on deputation for training in P. H. E. under the WHO Fellowship for a period of one year from Sept. 1971.

7. Shri A. K. Seth, Scientist proceeded to Federal Republic of Germany under the German Academic Exchange Service Programme for training in the field of water and waste water treatment for a period of one year from Dec. 1971.

8. Dr. G. J. Mohanrao Scientist-in-Charge was deputed to Geneva to act as Temporary Adviser to WHO in their Expert Committee Meeting on Methods of Waste Water effluents during Nov.—Dec. 1971.

9. The Indian Pulp and Paper Technical Association, New Delhi awarded Gold Medal to the best paper entitled "Characteristics of Pulp & Paper Mill Wastes and ISI Standards" by Dr. P. V. Sudrahmanyam, R. C. Parekh & Dr G. J. Mohanrao, presented at the Annual Meeting of the Association held on 8 th and 9 th November, 1971. The gold medal was donted by M/S Shalimar Wires and Industries Ltd, Calcutta.

10. Shri N. M. Parhad, Scienist was awarded Ph. D. degree in the Faculty of Science by the Nagpur University on his thesis entitled "Studies on the Microbial Flora of the Oxidation Ponds"

STAFF

HEADQUARTERS

DIRECTOR PROF. S. J. ARCEIVALA (Resigned w. e. f. 31-8-1971)

SCIENTIST-IN-CHARGE :-Dr. G. J. MOHANRAO (w. e. f, 1-9-71).

WATER TREATMENT

Shri K. R. Bulusu, Scientist-in-Charge
Shri B. N. Pathak, Scientist
Shri V. P. Thergaonkar, Scientist
Shri A. S. Bal, Scientist
Shri M. V. Nanoti, S. S. A.
Shri D. N. Kulkarni, J. S. A.
Mrs. M. V. Vaidya, J. S. A.
Shri W. G. Nawlakhe, J. S. A.

SEWAGE TREATMENT

Dr. R. H. Siddiqi, Scientist-in-Charge
Shri R. P. Mishra, Scientist
Dr. K. P. Krishnamoorthy, Scientist
Shri M. Parabrahmam, Scientist
Dr. G. B Shende, Scientist
Shri S. N. Kaul, Scientist
Shri B. K. Handa, Scientist
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Shri A. N. Khan, S. S. A.
Shri M. K. Abdulappa, J. S. A.
Miss M. G. Deshpande, J. S. A.

INDUSTRIAL WASTE TREATMENT

Dr. P. V. R. Subrahmanyam, Scientist-in-Charge
Shri M. V. Srinivasan, Scientist
Shri J. S. Gadgil, Scientist
Shri S. S. Mudri, Scientist
Shri S. B. Deshmukh, S. S. A.
Mrs. S. Satyanarayana, S. S. A.
Shri T. N. C. Ramaprasad, J. S. A. (On deputation to Ahmedabad Municipal Corporation, Ahmedebad.)
Shri S. N. Khaddakar, J. S, A.
Shri A. M. Deshkar, J. S A.

AIR POLLUTION & INDUSTRIAL HYGIENE

Shri J. M. Dave, Scientist-in-Charge (On deputation to Ministry of Health, Govt. of India)

Shri P. K. Yennawar, Scientist
Shri V. L. Pampattiwar, Scientist
Miss J. M. Deshpande, Scientist
Shri V. I. Pandit, S. S. A.
Shri S. N. Dixit, S. S. A.
Miss Rekha Jawanjal, J. S. A.
Shri J. V. Kothari, J. S. A.

WATER POLLUTION SURVEILLANCE

Shri R. C. Trivedi Scientist-in-Charge

MICROBIOLOGY (including VIROLOGY)

Dr. N. U. Rao, Scientist-in-Charge
Dr. V. Chalapati Rao, Scientist
Dr. N. M. Parhad, Scientist
Shri P. M. Phirke, Scientist
Shri M. D. Patil, Scientist
Dr. M. Vithal Rao, Scientist
Shri P. V. R. C. Panicker, Scientist
Shri P. Kumaran, Scientist
Shri S. R. Joshi, S. S. A.
Shri S. B. Lakhe, S. S. A.
Shri K. Subba Rao, J. S. A.
Shri S. I. Ilyas, J. S. A,
Shri N. Shivaraman, J. S. A.
Shri S. V. Waghamare. J. S. A.

ENGINEERING

Shri R. Paramasivam, Scientist-in-Charge
Miss N. S. Joshi, J. S. A.

SOLID WASTES DISPOSAL

Shri A. D. Bhide, Scientist-in-Charge
Shri S. K. Titus, Scientist
Shri B. Z. Atone, S. S. A.
Shri R. C. Dixit, S. S. A.
Shri S. R. Baisare, J. S. A.
Shri R. V. Bhoyar, J. S. A.
Shri S. S. Gautam, J. S. A.
Shri A. D. Patil, J. S. A.
Shri L. M. Motghare, J. S. A.

RURAL SANITATION

Dr. A. K. Anwikar, Scientist-in-Charge

INSTRUMENTATION

Shri V. L. Lekre, Scientist-in-Charge
Shri S. B. Dabadghao, Scientist
Shri V. R. Bhave, Scientist
Shri V. R. Apte, Scientist

TRAINING, INFORMATION, LIBRARY & EXTENSION SERVICES

Dr. G. K. Seth, Scientist-in-Charge
Shri R. K. Saraf, Scientist
Miss K. W. Choudhary, Scientist
Shri S. G. Bhat, Documentation Officer
Shri Y. N. Murty, S. T. A.
Shri K. M. Nandgaonkar, S. T. A.
Shri S. K. Kesarwani, S. T. A.

CONSULTATION CELL

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Shri S. R. Algarsamy, Scientist
Shri V. Hanumanulu, Scientist
Shri R. S. Nagabhushna, J. S. A.

COORDINATION CELL

Shri D. Raghuraman, Scientist-in-Charge

WORKSHOP

Shri G. T. Kale, Workshop Superintendent
Shri H. J. Patil, Scientist
Shri P. S. Tellewar, J. M. A.

CONSTRUCTION & MAINTENANCE

Shri N. M. Narasimhan, Clerk-of-Works

GLASS BLOWING SECTION

Shri N. Narayana, S. T. A.

PHOTOGRAPHY

Shri E. P. I. Sundersingh, S. T. A.

ZONAL LABORATORIES

AHMEDABAD

Shri S. Rajagopalan, Scientist-in-Charge
Dr. (Smt.) I. S. Jayangouder, Scientist
Shri S, G. Shaikh, J. S. A.

BOMBAY

Shri V. Raman, Scientist-in-Charge
Shri S. R. Kshirsagar, Scientist
Shri R. K Pandit Scientist
Shri S. K Gadkari, Scientist
Shri H. B. Singh, Scientist
Shri S. K. Maira, Scientist
Shri A. W. Deshpande, Scientist
Shri S N. S. Phadke, Scientist
Mrs. A. A. Chandorkar, S. S. A.
Shri N. S. Manthapurwar, S. S. A.
Shri G. Ramkumar, S. S. A.
Shri A. L. Kulkarni, J. S. A.
Shri S. V. Deshpande, J. S. A.
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Shri K. Rosario, J. S. A.
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Shri S. T. Kombade, J. S. A.
Shri K. M. Phadke, J. S. A.
Shri D. B. Bhattar, J. S. A.

CALCUTTA

Dr. A. K. Basu, Scientist-in-Charge
Shri R. S Dhaneshwar, Scientist
Shri C. S. G. Rao, Scientist
Mrs. D. Rao, J. S. A
Mrs. Giti Mukherjee, J. S. A.

DELHI

Shri J. M. Tuli, Scientist-in-Charge
Shri J. S. Jain, Scientist (On study leave)
Shri A. K. Seth, Scientist
Shri N. Dutta, Scientist
Shri S. K. Shrivastava, Scientist
Shri L. N. Sharma, S. S. A.

HYDERABAD

Shri Y. S. Murthy, Scientist-in-Charge (On deputation to U. S. A.)
Shri D. Seethapati Rao, Scientist
Shri I. P. S. Prasada Rao, Scientist
Shri K. Srinivasan, J. S. A.
Shri L. Shantikumar, J. S. A

JAIPUR

Dr. K. L. Saxena, Scientist--In-Charge
Shri H. C. Sharma, S. S. A.
Shri M. S. Olaniya, J. S. A.

KANPUR

Dr. H. C. Arora, Scientist--in--Charge
Shri S. N. Chattopadhyay, J. S. A.
Shri V. P. Sharma, J S. A.
Shri Tapan Routh, J. S. A.

MADRAS

Dr C. A. Sastry, Scientist-in--Charge
Shri T. K. Srinivasan, Scientist
Shri V. Kothandaraman, S. S. A.
Shri K. M. Aboo, J. S. A.

ADMINISTRATIVE & HOUSE-KEEPING STAFF

Shri P. K. Gokhale, Administrative Officer (Grade I)
Shri V. K. Bhatnagar, Accounts Officer
Shri A. N. Zutshi, Administrative Officer (Grade II)
Shri Kuldip Rai, Section Officer
Shri R. Narayana, Stores Officer
Shri Thomas Joseph, Purchase Officer
Shri R. C. Bajpai, S. T. A.
Sori G. L. Banerjee, S. T. A.
Shri M. P. Vyas, J. T. A.
Shri U. P. Chattopadhya, Senior Accountant
Shri Santosh Kumar, Junior Accountant
Shri Kishorilal, Assistant
Shri Amarsingh, Assistant
Shri R. C. Maheshwari, Assistant
Shri N. C. Chakrabarty, Assistant
Shri B. Y. Badge, Senior Stenographer
Shri Hamidkhan, Senior Stenographer
Shri B. Damodaran, Senioar Stenographer
Shri H. V. Garde, Laboratory Supervisor
Shri J. H. Govind, Watch, & Ward Assistant
Mrs. I. D'Souza, Receptionist.

DISTINGUISHED VISITORS

1.	Dr. Atma Ram	Director-General, Scientific & Industrial Research New Delhi.
2.	Dr. B. D. Nag-Choudhri	Scientific Adviser, Ministry of Defence, Government of India, New Delhi.
3.	Dr. H. N. Sethna	Director, Bhabha Atomic Research Centre, Trombay, Bombay.
4.	Mr. Norman C. Dahl	Deputy Representative, The Ford Foundation, New Delhi.
5.	Th. G. Martijn	Manager, WHO International Reference Centre on Community Water Supply, The Hague, The Netherlands.
6.	Prof. R. S. Engelbrecht	Department of Civil Engineering, University of Illinois, Urbana, Illinois, (USA)
7.	Mr. L. W. Lefke	Solid Wastes Research Environmental Protection Agency, Cincinnati, Ohio (USA)
8.	Brig. G. R. Chainani	Director General, Labour Institute, Bombay.
9.	Shri Pitambar Pant	Member, Planning Commission, Government of India. New Delhi.
10.	Dr. Roger Revelle	U. S. Academy of Sciences, Washington, U. S. A.
11.	Prof. Perry T. McCarty	
12.	Prof. J. C. Geyer	
13.	Mr. Donald W. Pritchard	
14.	Mr. Paul H. Jones	
15.	Prof. Gerard A. Rohlich	
16.	Dr. D. Pimentel	

Inauguration of the Training Laboratory at the hands
of Dr. Atma Ram, Former Director General, CSIR.